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AGRICULTURAL CHEMISTRY

SOME CHEMICAL STUDIES OF THE NAVY BEAN (*PHASEOLUS VULGARIS*)

Arnold C. Ott, Thesis (Ph.D.)
Michigan State, 1943

Since the state of Michigan grows more navy beans than any other state in the Union, it was desired to know more of the chemical nature of this legume.

The fact is known that older beans are much less permeable to water than newly grown beans. Consequently, the polyuronide, "true pentosan" and protein contents of four differently treated lots of seed coats was studied. Lot I was left untreated, Lot II was treated with 1% acetic acid for 10 hours @ 60° C., pH 2.8; Lot III was treated with 0.8% sodium hydroxide for 10 hours at 60° C., pH 11.5; while Lot IV was treated with 1% sodium bicarbonate solution for 10 hours @ 60° C. and pH 7.8. All lots were washed seven times with distilled water and then air dried.

The results obtained showed that the polyuronide and the "true pentosan" content of the navy bean seed coats are about 19% and 21% respectively, of their dry weight. The protein is about 5% of the dry weight of the seed coats.

Treatment of the coats with 0.8% sodium hydroxide lowers the content of both polyuronide and "true pentosan", while 1% acetic acid and 1% sodium carbonate have little effect.

Protein of the seed coats is slightly lowered by sodium bicarbonate treatment and noticeably by treatment with sodium hydroxide.

From the percent moisture in the seed coats, determined by oven-dry method, there is evidence for polyuronides and "true pentosans" being involved in water retention.

Studies on the whole bean showed the crude lipid and unsaponifiable matter to be about 2.65% and 0.15% respectively of the air dry beans.

A modified method, based on the Liebermann-Burchard reaction has been presented for the determination of crude sterols. The crude sterols of the navy bean unsaponifiable are about 59%.

Forty kilograms of finely ground navy beans were exhaustively extracted with ethyl ether. The oil obtained was saponified as usual and a study of the crude sterols made. Stigmasterol and β -sitosterol were isolated. The former makes up about 25% of the crude sterols while the latter exists to the extent of about 5%. An unidentified sterol with a high negative rotation has been isolated. Also two different probable saturated hydrocarbons have been isolated from the navy bean oil.

Separation studies were made on crude sterols separated from navy bean oil, namely, chromatographic, electrophoretic and triangular fractionation. Only the latter was successful.

A vitamin-D activity of 700 U.S.P. units per gram of crude navy bean oil unsaponifiable matter was observed.

The proteins of the ground whole navy beans have been effectively extracted with 0.5% sodium sulfite solution and precipitated satisfactorily with sulfur dioxide. The protein, so obtained, is adaptable to plastic formation as has been shown by a number of experiments.

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BIOLOGICAL CHEMISTRY

THE ROLE OF pH IN DETERMINING THE TOXICITY OF AMMONIUM COMPOUNDS

Walter A. Chipman, Jr., Thesis (Ph.D.)
University of Missouri, 1934

A review of the literature on the toxic effects of ammonium compounds on various aquatic plants and animals shows that there is a great variety of factors influencing this toxicity. One of the most important of these is the pH of the medium. The present experiments were made in an attempt to correlate definitely the toxicity of ammonium salts to aquatic animals with pH and to offer an explanation for this relationship.

Although the dissociation of ammonium salts in solution results chiefly in the liberation of ammonium ions and the acid ions with which the ammonia is combined, there is also some hydrolytic dissociation so that there are always present in a solution of an ammonium salt small amounts of the free acid and ammonium hydroxide, which further dissociates to form water and ammonia gas. The pharmacological action of most salts is due to the ions of the salts, but in the case of the ammonium salts the action is of two types. One can be ascribed to the ammonium ions, but the other results from the undissociated ammonia set free by hydrolytic dissociation.

A number of experiments were carried on comparing the relative toxicity of solutions of ammonium chloride, ammonium sulfate and ammonium carbonate to goldfish. The results of these experiments confirmed the fact that the alkaline ammonium salts are much more toxic than the acid salts, since the strongest solution of NH_4Cl prepared with tap water in which the goldfish survived 360 hours was 0.002 N, of $(\text{NH}_4)_2\text{SO}_4$ 0.0015 N and of $(\text{NH}_4)_2\text{CO}_3$ 0.0007 N. In experiments comparing the salts in distilled water solutions a 0.005 N $(\text{NH}_4)_2\text{CO}_3$ solution killed

goldfish at 3.58 hours on an average, although 0.1 N NH_4Cl solution was not lethal within 12 hours.

It was also found that the toxicity of NH_4Cl solutions to goldfish was much greater when prepared with tap water than when prepared with distilled water, confirming earlier experiments.

In a series of experiments it was observed that a 0.05 N NH_4Cl solution prepared with distilled water was not toxic to goldfish, but became toxic upon the addition of NaOH , Na_2CO_3 and Na_2HPO_4 , the increased toxicity being in proportion to the reduction of the free H-ions. The addition of NaH_2PO_4 , which rendered the solution more acid, did not increase the toxicity.

The same relationship between the toxicity of ammonium chloride solutions and the presence of NaOH , Na_2CO_3 and Na_2HPO_4 was found for the freshwater amphipods, Gammarus fasciatus Say and Eucran-gonyx gracilis (Smith). Similarly the addition of NaOH , Na_2CO_3 and Na_3PO_4 increased the toxicity of 0.01 N NH_4Cl solutions to Daphnia magna Straus.

Experiments using fish, amphipods and cladocerans showed that the toxicity of NH_4Cl solutions varied with the pH of the solution, the more alkaline solutions being the more toxic. Curves obtained by plotting the survival time against pH were typically hyperbolic in shape, and curves obtained by plotting percent dead against pH were sigmoid, similar to toxicity curves obtained by plotting survival time or percent dead against concentration of a poison. This variation in toxicity of ammonium chloride with pH was apparently directly associated with the dissociation of the salt, for all data seem to indicate that within reasonable limits the toxicity is definitely a factor of pH, and therefore of the dissociation into free ammonia, regardless of the salt used to obtain the pH value. This statement is supported particularly by tests on 10,180 cladocerans which data show that the toxicity of NH_4Cl solutions at a given pH was the same whether

the pH level and the dissociation induced were the result of the addition of NaOH, Na_2CO_3 or Na_3PO_4 .

Chemical equations for the dissociation and adjustment of NH_4Cl at different pH values present results which fit the biological data as found if the toxicity of NH_4Cl solutions be ascribed to the undissociated ammonia ($\text{NH}_4\text{OH} + \text{NH}_3$).

It seems reasonable to conclude on the basis of the experiments performed that the toxicity of ammonium salts is directly related to the concentration of undissociated ammonia ($\text{NH}_4\text{OH} + \text{NH}_3$) in the solution. The role of pH in the toxicity of these salts is the regulation of this undissociated ammonia by the free H-ions present in the solution, regardless of the salts used in the adjustment of the pH.

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A STUDY OF THE RELATIONSHIP BETWEEN THE pH
VALUES OF THE CONTENTS OF THE INTESTINAL TRACT
AND THE DEPOSITION OF CALCIUM IN THE BONES OF RATS

Sylvia Cover, Thesis (Ph.D.)
University of Missouri, 1933

The purpose of this investigation was to furnish further evidence and, thereby, clarify conflicting reports as to whether or not the pH values of the intestinal contents control calcification and rachitic changes in the bones of rats.

In Part I, entire litters were divided into two groups: (1) negative controls, which received the Sherman-Stiebeling diet alone; (2) positive controls, which received in addition viosterol or irradiation with ultra violet light as a source of vitamin D. The following tests were made: (1) analyses of femurs for percentage ash and percentage calcium; (2) determinations of the pH values of the intestinal contents. The results from the bone analyses of 54 negative controls and 62 positive controls confirm the finding of Sherman and Stiebeling that there is a highly significant increase in calcification resulting from the addition of an adequate amount of vitamin D to the basal diet. The pH values of the contents of both upper and lower sections of the small intestine were slightly lower for the positive than for the negative controls. But, when this difference in the pH values is compared with the difference in calcification in the same animals, the latter difference is the more striking.

Rachitic changes, as evidenced by X-ray and histological examinations, were produced in the bones of rats on the Sherman-Stiebeling diet, although it contains a satisfactory ratio and level of calcium and phosphorus and is adequate for rats except for vitamin D. These changes did not occur

when vitamin D was added to the basal diet. It has been shown, therefore, that vitamin D is necessary to prevent rachitic changes in the bones of rats even when the diet is adequate in all other respects.

In Part II, graded portions of sodium hydroxide or sodium carbonate were added to the basal diet. The following tests were made: (1) determinations of the pH values of the intestinal contents, (2) analyses of green femurs for percentage ash, (3) X-ray, and (4) histological examinations. At the 6 percent level of sodium carbonate, which made the diet equivalent to 1211 m.l excess 0.1 normal alkali, the results were more striking than at the lower levels of alkali. In this group the pH values of the contents of the upper part of the small intestine were definitely increased above the values for the negative controls and were accompanied by less evidence of rickets by X-ray and histological examinations, but by a slightly lower percentage ash in green femurs.

In Part I, higher pH values were obtained for the negative controls than for the positive controls. Rachitic changes were produced in the negative controls but not in the positive controls. In Part II, results were obtained, which were contradictory to those in Part I as to the relationship between the intestinal pH and rachitic changes. In Part II, intestinal pH of the group receiving 6 per cent sodium carbonate was higher than that for the negative controls but the incidence of rickets was less, even though the appearance of the bones was not normal. It would seem, therefore, that there is no relationship between intestinal pH and rachitic changes in the bones of rats and that the antirachitic action of vitamin D cannot be explained on the basis of its effect in changing the intestinal pH.

In Part I, significantly lower percentage ash and slightly higher pH values were obtained for negative than for positive controls. In Part II, slightly lower percentage ash and definitely higher

pH values were obtained for the group receiving 6 per cent sodium carbonate than for the negative controls. It appears, therefore, that there is no direct relationship between the pH values of the intestinal contents and the percentage ash in green femurs. It would seem that vitamin D plays a role in calcification not explained by its effect in changing the pH values of the intestinal contents.

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FACTORS INFLUENCING PHOSPHOLIPID METABOLISM

Marjorie Janice Groothuis, Thesis (Ph.D.)

University of Michigan, 1943

The phospholipids are generally considered to be involved in the transportation of fat or fatty acids for metabolic purposes. Of all the organs of the body the liver is by far the most active with respect to fat metabolism, and the lipid content of the liver is profoundly influenced by such common dietary constituents as choline, cystine, methionine, and cholesterol. It may be expected, therefore, that if the phospholipids serve as a conveying mechanism for fatty acids, any compound which affects the liver lipid content should likewise affect the liver phospholipids. Such changes in the phospholipids might be of a qualitative or quantitative nature.

In this investigation quantitative changes in the liver lipids and liver phospholipids in the rat (100-190 gm.) following the administration of the dietary factors cystine (250 mg.), choline chloride (30 mg.), dl-methionine (250 mg.), and elaidin were studied. Qualitative changes in the phosphoric acid residue of the phospholipid molecule were studied through the use of radioactive phosphorus. An attempt was made to "label" the fatty acid residues of the phospholipids through administration of the unnatural fatty acid elaidic acid. The presence of elaidic acid in the liver phospholipids can be detected through the determination of the iodine number of the saturated fatty acid fraction obtained from the phospholipids.

Changes in the liver lipid content of the adult rat (250 gm.) resulting from the feeding of supplementary casein, cystine, and methionine were also studied.

From the results of these experiments it can be concluded that:

1. Maintenance of the animals (100-190 gm. rats) on the stock high fat diets for 15 to 28 days results in an increased liver lipid content and a decreased liver phospholipid content.

2. In the adult rat (250 gm.) the lipotropic action of a 20 per cent casein diet is due to the methionine content.

3. If the liver lipid content is high (above 15 per cent) and the liver phospholipid content is lower than normal (3.2 per cent of the moist fat free liver) the oral administration of choline chloride (30 mg.) or of methionine (250 mg.) will effect a decrease in the liver lipids, within eight hours after administration, in 75 per cent of the animals receiving the supplement.

4. If the liver phospholipid content is low, the administration of choline chloride, methionine, and elaidin will effect an increase in the absolute amount of the phospholipids present in the liver.

5. The administration of choline chloride, cystine, and methionine always causes an increase in the "turnover" of the phospholipid phosphorus within eight hours after the administration; elaidin leads to an increase in the "turnover" of the phospholipid phosphorus only in those instances in which its administration also effects an increase in the liver phospholipid content.

6. It was found impossible to "label" the phospholipid fatty acids by including elaidin in the diet; no evidence of the presence of elaidic acid in the liver phospholipid fatty acids was obtained. These results differ from those obtained by Sinclair, and the disagreement is undoubtedly due to differences in the analytical procedure employed. Evidence obtained from the work with elaidin indicates that the relatively high iodine numbers obtained by Sinclair in his work were probably due to varying amounts of a colored contaminant which can be removed only with difficulty and which has a relatively high iodine number.

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NUTRITIONAL REQUIREMENTS OF RABBITS, GUINEA PIGS AND HAMSTERS

John William Hamilton, Thesis (Ph.D.)
University of Missouri, 1943

Rabbits and guinea pigs grow normally on simplified rations such as No. 5161, which has the following composition: dextrin 30, casein 20, cellulose 15, lard 11, salts 4, brewer's yeast 15 and corn starch 5. The diet is fortified with vitamins A, D and E. The guinea pigs received vitamin C in addition. This diet is not adequate, however, for reproduction. Rabbits weaned 29 per cent of their young, and guinea pigs none. Every young guinea pig, and most of the young rabbits, had extensive hemorrhages throughout the body. On the assumption that the high mortality was due to a vitamin K deficiency, 0.005 per cent of 2-methyl-1, 4-naphthoquinone was included in the diet. After this change 61 per cent of the rabbits, and 85 per cent of the guinea pigs were weaned, and the incidence of hemorrhages was negligible.

To produce severe symptoms of a vitamin K deficiency, the females should undergo a depletion period prior to the birth of their litters. Periods of 55 days for rabbits, and 45 days for guinea pigs are recommended.

Blood samples, obtained by heart stab, from young K-deficient guinea pigs had prolonged clotting and prothrombin times. Duke's bleeding time was normal.

Soybean and wheat germ oils were used as sources of vitamins E and K. These oils supply adequate amounts of vitamin E, but neither is a reliable source of vitamin K. Rabbits receiving the soybean oil ration weaned 30 per cent, and 83 per cent of the dead were hemorrhagic. The weaning percentages of rabbits and guinea pigs receiving the wheat

germ oil ration were 24 and 36 per cent respectively. Most of the dead animals were hemorrhagic.

A phytol concentrate, prepared from alfalfa, was included in a rabbit diet at a level of 0.02 per cent. This increased the percentage weaned to 48 per cent, and markedly decreased the proportion of deaths from hemorrhage. A daily dose of 5 mg. of purified phytol was administered to guinea pigs as a substitute for vitamin K. This supplement increased the weaning percentage to 60, and reduced the incidence of hemorrhage from 100 to 12 per cent.

Dried yeast contains all water-soluble vitamins required by rabbits or guinea pigs for growth and reproduction and these vitamins can be extracted with hot water. Considerable quantities of extraneous material are precipitated by adding alcohol to a concentration of 50 per cent. Guinea pigs grow at a normal rate if two per cent of the 50 per cent alcohol soluble material is included in their diets. Females weaned 89 per cent of their young when the amount was raised to 4 per cent. An aqueous extract of liver is also an excellent source of the unrecognized vitamins required by these animals.

Hamsters grow at a normal rate on a ration of casein 20, dextrose 65, lard 8, cellulose 3 and salts 4, supplemented with vitamins A, D, E, K, thiamine, riboflavin, pyridoxine and pantothenic acid. If nicotinic acid, choline and inositol are added, the ration described above is adequate for reproduction. If inositol is omitted the females bear shapeless, decomposed and bloody embryos. None was alive at birth. If nicotinic acid or choline, or both, are omitted the weaning percentage is reduced.

On a vitamin E-deficient ration the animals grow slowly and the deficiency becomes acute in 4 to 16 weeks. The animals collapse suddenly and die in about an hour. One animal was given 5 mg. of alphatocopherol shortly after collapse and made a spectacular recovery.

Hamsters on a vitamin K-deficient diet continue to grow for 4 to 6 weeks and then remain stationary, or decline, in weight for 2 or 3 weeks. They then resume growth and attain normal mature weights. Examination disclosed hemorrhagic areas during the period of arrested growth.

If vitamins E and K are omitted from the diet at the same time the hamsters grow slowly, collapse and die after 5 to 17 weeks on the ration. These animals are severely hemorrhagic.

Three generations of hamsters have been reared on simplified diets which contain no vitamins except those now recognized as such.

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VITAMIN DEFICIENCIES IN RATIONS OF NATURAL FEEDSTUFFS

Hubert Heitman, Jr., Thesis (Ph.D.)
University of Missouri, 1943

Approximately 40 per cent of the pigs born alive in the corn belt die before they are old enough to wean. This high mortality rate persists even when the rations of the mothers are adequate according to current feeding standards. Earlier studies at Missouri have shown, however, that these standards are faulty and a large part of the mortalities are due to nutritional deficiencies. It seems quite certain that the most important deficiency is in one or more unrecognized vitamins, and it was decided to study these deficiencies with the rat in pilot trials.

A swine ration used extensively in studies of this problem was slightly modified by including casein to raise the protein content. The basal ration used most frequently in our studies consists of ground yellow corn- 69.96, tankage- 10, casein- 7, linseed oil meal- 5, alfalfa meal- 5, vitamin A-D concentrate- 1, common salt- 0.87, ground limestone- 0.60, steamed bonemeal- 0.50, $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$ - 0.04 and FeSO_4 - 0.03 per cent.

Female rats received this ration from weaning, and even though they eventually attained normal mature weights, their growth rates were about 80 per cent of the normal. By use of paired feeding trials with weaning rats it was determined that some combination of thiamine, riboflavin, pyridoxine and pantothenic acid increased the growth rate to normal and was as effective as was a supplement of all fourteen known vitamins. No one of the four mentioned is effective alone in improving growth, and it has not been determined whether any of them can be omitted from the combination without impairing its effectiveness.

The females were mated with normal males, and it was apparent that the ration supported normal reproduction through parturition. The young were normal in every respect at birth. However, only 16.5 to 63.0 per cent were weaned at 28 days of age, and the weaning weights were subnormal. The only characteristic symptom was a lethargic condition preceding death. Moderately fatty livers (which were prevented by choline) were found at autopsy, and in a few exceptional cases hemorrhages were observed. No acetone bodies could be detected in the urine, and anemia was not observed. The whole blood clotting time and the prothrombin time appeared to be normal.

Addition of choline to the basal ration increased the weaning percentage by 8.7 to 36.7 per cent. Further addition of all other known vitamins was no more effective than was choline alone. Choline did not improve the rate of growth of the suckling young, but the addition of thiamine, riboflavin, pyridoxine and pantothenic acid, with or without choline, increased the rate of growth of the litters to normal. The addition of all other known vitamins had no further effect.

Because addition of known vitamins to the basal failed to make the ration entirely adequate during the suckling stage, beef liver was used as a supplement. Dried liver, or aqueous or alcoholic extracts, increased the survival rate to normal and sustained normal growth. The accelerated growth rate is attributed to the four known vitamins mentioned above, and the effect on litter survival is attributed to the presence of an unrecognized vitamin. The active factor is adsorbed on fuller's earth at a pH of 1. A folic acid concentrate proved to be an excellent source of the litter survival factor, and this observation suggests that folic acid is related to, if not identical with, the unrecognized survival factor.

These studies indicate that the rations commonly supplied to swine do not contain an abundance

of certain B vitamins. These rations lack some combination of thiamine, riboflavin, pyridoxine and pantothenic acid. They are also deficient in some unrecognized vitamin of special importance during the suckling stage. Our observations indicate that the deficiency does not affect lactation itself, but rather the quality of the milk, as the rats die with stomachs filled with milk. Undoubtedly this unknown factor is present in a variety of feedstuffs, but it is not present in large quantities in those concentrates commonly supplied to swine.

It is believed that the differences in the natures of the deficiencies before and after weaning are related to symbiotic microbial synthesis in the alimentary canal.

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A STUDY OF SOME OF THE FACTORS INFLUENCING THE
LIVER GLYCOGEN CONTENT OF YOUNG WHITE RATS

Yen-Hoong Loo, Thesis (Ph.D.)

University of Michigan, 1943

The purpose of this investigation was a study of some of the factors influencing the fasting liver glycogen value in the young white rat in order to determine whether a basal level could be established. An attempt was made to control the strain, sex, age, and environmental conditions of the animals and to employ standard experimental procedures. With these factors as carefully controlled as possible, a study was made of the influence of two important variables on the fasting liver glycogen, namely (1) the character of the previous diet and (2) the duration of the fasting period.

Following a general discussion of glycogen, the literature concerned with the factors influencing the fasting liver glycogen content of the white rat is reviewed. The wide range of values reported by different investigators and the variability in the conditions under which their experiments were performed are summarized.

The procedure of stunning and decapitation was preferred to anesthetization with amytal as a method of sacrifice. No advantage was found in freezing the tissue immediately after the death of the animal and prior to the treatment with alkali.

The results of experiments with three different stock diets and a series of seven synthetic diets, as well as data obtained from studies on the effect of 24, 48, and 72 hour fasting periods, are analyzed statistically.

Rats were fed isocaloric diets which varied in their content of protein and carbohydrate. At the end of a 24 hour fast, a significantly greater concentration of liver glycogen was found in the

rats previously fed a high protein diet than in those receiving a high carbohydrate ration. A fat-rich diet did not exert the same influence as a protein-rich one. With a constant carbohydrate intake, animals fed a high protein, low fat diet had a higher fasting liver glycogen level than those offered a low protein, high fat ration. Livers of rats consuming the same amount of protein but varying quantities of fat and carbohydrate contained approximately the same amount of glycogen after a 24 hour fast. There was no correlation between the per cent of liver glycogen and the following: (1) average daily gain in body weight, (2) loss in body weight during the fast, (3) weight of the liver. These results definitely indicate that in determining the liver glycogen concentration of rats during inanition the protein content of their previous diet is most significant.

Under the conditions of these experiments, there was no significant difference between the 24 and the 48 hour fasting liver glycogen levels, but the latter was more variable. Regardless of the character of the previous diet, the concentration of liver glycogen increased and was considerably greater at the end of a 72 hour fast than after either a 24 or 48 hour period.

To establish a basal liver glycogen level it is recommended that a 24 hour fasting period be used and the following factors be considered and standardized, as far as possible: (a) strain, sex, age, weight of animal, (b) environmental temperature during inanition, (c) excitation of the animal on handling, (3) diurnal variation, (3) food intake, (f) previous diet, (g) experimental technique.

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ADDITIONAL OBSERVATIONS ON THE CHICK ANTIANEMIA FACTOR

Boyd Lee O'Dell, Thesis (Ph.D.)
University of Missouri, 1943

While attempting to devise a simplified diet that is adequate for the chick, Hogan and Parrott observed that on certain rations the chicks developed an anemia. It was shown that the syndrome was due to a deficiency of an unrecognized vitamin which is abundant in aqueous extracts of liver. This factor was tentatively called vitamin B_c. The purposes of the present investigation were (1) to develop a technique for the assay of vitamin B_c and (2) to obtain additional information on its chemical properties.

During the course of this investigation over 1500 chicks have been used to determine the most suitable diet for the production of anemia. The chicks that developed anemia were used in a curative type of assay to estimate the activity of various fractions which were prepared in an attempt to concentrate the vitamin and to gain additional information concerning its properties.

The diets were of the simplified type consisting of casein, corn starch, salts, lard, vitamins, and various vitamin carriers including extracts of liver, rice bran, and egg yolk. As additional synthetic vitamins became available, it was possible to replace the crude carriers by purified vitamins. The composition of one of the simplest and most satisfactory diets is as follows:

| | | | |
|---------|----|---------------------------------|-----|
| Casein | 25 | Wheat germ oil | 4.5 |
| Gelatin | 10 | Salts | 4.0 |
| Dextrin | 56 | Concentrate of Vitamins ADEK | 0.5 |

| Vitamins added per 100 grams of ration | | | |
|--|---------|------------------|-----------|
| Thiamine | 0.4 mg. | Choline chloride | 200.0 |
| Riboflavin | 0.8 " | Nicotinic acid | 10.0 |
| Pyridoxine | 0.3 " | Inositol | 100.0 |
| Calcium | | Biotin (Conc.) | 10.0 mcg. |
| pantothenate | 2.0 " | | |

If lard is substituted for wheat germ oil in this diet, the incidence of anemia is higher, but the high mortality among the anemic chicks makes such a change inadvisable. The addition of sulfagaunidine to the basal diet increases the incidence of anemia. Since this drug inhibits bacterial growth, it was concluded the chick normally obtains at least part of its requirement for the antianemia vitamin by bacterial synthesis in the intestine. Chicks which receive high levels of B₆ do not develop anemia as readily as those that receive smaller amounts. It is supposed that the additional pyridoxine aids in the bacterial synthesis of vitamin B₆. It was also shown that the diet of the laying flock affects the incidence of anemia in the checks. For the successful production of anemia, the hens should be restricted to dry feeds. The antianemia factor is abundant in green leaves, such as grass, and it is probable that it is stored in the egg and transmitted to the chick.

Aqueous extracts of liver were used as the starting material for the fractionation studies in an attempt to concentrate the antianemia factor. Adsorption on fuller's earth from acid solution and subsequent elution with dilute ammonia affords the most satisfactory initial step in its concentration. Readsorption and elution are also helpful. However, there is considerable loss associated with the adsorption procedure which can be explained at least partially by the lability of the factor in acid solution. The vitamin is quite effectively precipitated by phosphotungstic acid, but other precipitants, such as lead, mercury, zinc, and silver offer little

promise because their use entails considerable loss. The vitamin is insoluble in most of the common organic solvents, including butanol, pentanol, acetone, pyridine, ether and chloroform. It is slightly soluble in dioxane and quite readily soluble in glacial acetic acid, phenol and methanol.

The properties of the vitamin indicate that it is very similar to, if not identical with, the factors which have been designated by various investigators as the eluate factor, Factor U, and folic acid.

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FACTORS INFLUENCING THE DEPOSITION OF "FAT" IN THE LIVER

Eugene Roberts, Thesis (Ph.D.)
University of Michigan, 1943

The experiments reported in this thesis were designed to deal with some problems relative to the deposition of "fat" in the liver.

In view of the possibility that the lipogenic action of cystine might be due to the liberation of hydrogen sulfide from it by the liver, the effect of sulfide on the liver lipid content of rats on a low protein-high fat diet was studied. The injection of subtoxic doses of sulfide had little effect on the liver lipid content of young white rats on a diet which caused the production of fatty livers. Since the sulfide seemed to stimulate the growth of rats on diets containing suboptimal levels of casein, the possibility of the conversion of inorganic sulfide to cystine sulfur by the rat is suggested.

Since little data on the subject were available at the time this work was initiated, the choline content of the livers of normal rats and rats with fatty livers was determined. The concentration of choline chloride in the livers of rats maintained on a stock (Rockland) diet remained constant. On a low protein diet, supplementation with choline was ineffective in keeping the liver choline content at a normal level.

The creatine content of the gastrocnemius muscle of normal rats was compared with that of rats whose livers contained abnormal quantities of "fat" in order to determine whether the ability of the rat to synthesize a methylated compound other than choline would be impaired on diets which cause the production of fatty livers. The creatine content of the gastrocnemius muscle of rats with fatty livers

remained normal. It was concluded that the synthesis of creatine proceeds at a normal rate in these animals.

In order to gain further information as to a possible mechanism for the removal of the methyl group from methionine which would be compatible with the data obtained from dietary and in vitro experiments, seven S-methyl compounds were tested with respect to their lipotropic activity. Dimethyl disulfide, S-methyl isothioureia sulfate, dimethyl sulfide, and methyl xanthogenate exhibited some lipotropic action; while methionine sulfone, dimethyl sulfone, and trimethyl sulfonium chloride were inactive in this respect. From a chemical point of view, it appeared that those of the above compounds which exerted lipotropic actions could readily serve as potential sources of methyl mercaptan, while this was not the case with the other substances. A consideration of these data in conjunction with those obtained by other workers suggested the possibility that the lipotropic action of methionine may be due to the labilization of the whole methiol group and not to simple demethylation.

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BOTANY

A COMPARISON OF X-RAY INDUCED MUTATIONS AND MUTATIONS OCCURRING SPONTANEOUSLY IN RING CHROMOSOMES IN MAIZE

Edward Allan Weaver, Thesis (Ph.D.)
University of Missouri, 1942

It is the purpose of this study to compare mutations in maize induced by X-ray with spontaneous mutations which are phenotypically similar and which are located in the same chromosomal region. In 1932 Stadler suggested that the action of X-radiation might be the production of extra-genic rather than intra-genic changes. Since that time his studies of the X-ray and spontaneous mutants occurring at specific loci in maize have emphasized the distinction between the two groups of mutants (Stadler, 1941).

A portion of the chromosomal complement of maize which is normally located adjacent to the centromere in the short arm of chromosome 5 has been analyzed for cell-viable mutants which presumably resulted from the mechanical breakage of a chromosome (McClintock, 1941). These spontaneous mutants were produced in ring chromosomes, and the mutant effects were associated with changes in the chromatin constitution of the ring chromosomes. In some cases the changes were definitely identified as losses of chromatin material.

In order to obtain X-ray induced mutations in the same chromosomal region for comparison with these spontaneous mutations, the following method was utilized. Irradiated pollen from a chromosomally-normal plant was placed on the silks of a plant which carried one of the small deficiencies in each of its number 5 chromosomes and which carried also at least one ring chromosome which compensated for the homozygous deficiency in the rod chromosomes. The F_1 plants which resulted from this cross

contained, therefore, an irradiated rod chromosome 5, a deficient rod chromosome 5, and a compensating ring chromosome. In such a plant sporophyte sectors which are haploid for a portion of the irradiated chromosome 5 will be initiated by loss of the ring chromosome (McClintock, 1938). All cell-viable mutants with recognizable phenotypic effects which are induced within this haploid region of the chromosomal complement can be observed as sectors in these F_1 plants.

Eleven variegated F_1 plants which showed sectors with some change in the chlorophyll condition and growth rate of the tissue were obtained in an X-ray progeny of 1036 plants. Three of these variegated F_1 plants produced sectors which were similar in appearance to ring chromosome mutants reported by McClintock (1941). These three types were selected for study and comparison with the ring chromosome mutants. One, a white sector type, was not recovered in subsequent generations.

The second mutant, bdx, produces a blotched chlorophyll pattern followed by drying of the tissue. The growth-rate of bdx tissue is nearly normal. This factor is transmitted through both the male and female gametophytes without the presence of the normal Bdx locus, although the rate of transmission through the male gametophyte is reduced. An inviable kernel type in which the endosperm and embryo are discolored is associated with the factor. This mutant is indistinguishable in appearance, gametophytic transmission, in the abnormal kernel type produced, and in inviability in homozygous condition from a ring-chromosome mutation, blotch-dries, found by McClintock in the same chromosomal region.

The third mutant, pbx, also produces a blotched chlorophyll pattern, but there is no tendency for pbx tissue to dry. The rate of growth of this tissue varies considerably but is always poor. This factor is transmitted through the male gametophyte only when accompanied by the normal Pbx locus.

Transmission through the female gametophyte occurs in the absence of the Pbx locus, but the rate is reduced. Evidence is presented to show that this factor produces a deleterious effect upon endosperm tissue when its normal Pbx locus is not present. The mutant pbx is indistinguishable in appearance and gametophytic transmission from a ring-chromosome mutation, poor-growth-blotch.

The two mutants, bdx and pbx, are not allelic as determined by the F_1 cross between the mutants.

An intensive study was made of bdx and pbx chromosomes 5 in the pachytene stage in an effort to detect any consistent abnormality in these chromosomes. No deficiencies or other changes could be observed.

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CHEMICAL ENGINEERING

THE PREPARATION, PROPERTIES, AND OILINESS OF SEVERAL DISPERSIONS OF METALLIC SOAPS IN LUBRICATING OIL AND A COMPARISON OF THESE DISPERSIONS WITH OLEIC ACID DISPERSED IN OIL

John Michael Hannegan, Thesis (Ph.D.)
University of Missouri, 1935

The oleates of Cd, Cu, Pb, Mg, Ni and Zn have been prepared, purified and their properties determined. In the course of the preparation of these metallic soaps, five methods of synthesis were investigated, of which three were considered to be applicable to certain of these soaps. These were (1) metathesis from the metallic salt and the sodium soap in aqueous solution, (2) the reaction of the metallic oxide and the free fatty acid in alcoholic solution, and (3) the electrolysis between electrodes of the metal desired in the soap of a solution of the fatty acid in 95% alcohol. The third method, which was developed during this investigation, is thought to be particularly applicable to the preparation of aluminum soaps. A method of purification of the soaps was found which obviated many of the difficulties in the preparation of metallic soaps.

A number of anhydrous dispersions of these metallic soaps in mineral oil were prepared. The density, viscosity, surface tension, the interfacial tension between the dispersions and mercury, and the coefficient of friction were determined for each dispersion. In general the presence of the metallic soaps increases the viscosity, decreases the interfacial tension, increases the "oiliness" and decreases the coefficient of friction of the oil, but has little or no effect on the density or surface tension.

The data indicate that the decrease in coefficient of friction is far in excess of the amount which could be predicted on the basis of changes in

the viscosity and is thus attributed in part to adsorption of the metallic soaps on the surfaces lubricated. A subsequent investigation has confirmed this conclusion.

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CHEMISTRY

BASIC CHROMIC NITRATES

Dorothy G. Engle, Thesis (Ph.D.)
University of Michigan, 1940

THE PROBLEM

A brief survey of some of the unusual properties of chromic salts encountered by previous workers is given to show the need of further study of these salts. Immediate interest lay in the fact that difficulties are sometimes encountered in the precipitation of silver chloride and mercurous chloride in Group 1, if chromium salts are present. The purpose was to help explain this curious behavior of chromium salts.

The silver and mercurous chlorides may be peptized into a milky suspension which cannot be coagulated with nitric acid and shaking, as they usually can be. The chromic chlorides and the chromic sulfates at hand did not show this peptizing action. Certain samples of chromic nitrate did exhibit it, while some samples from other supply houses, or even other lots from the same house with the same label but different lot numbers, did not.

Comparison of the physical and chemical properties of the chromic nitrates which do peptize silver chloride and those which do not led to the conclusion that it is the basic chromic nitrates that do the peptizing, hence this investigation is a study of basic chromic nitrates.

CONTENTS

A survey is given of the work previously done in the field of basic chromic salts.

The peptizing action, of commercial and synthetic basic chromic nitrates of different types, was studied under different conditions and from different standpoints. Previously three types of chromium had been distinguished in basic chromium

salts. These were studied, and a modified method of analysis was set up. Then the peptizing action was correlated with the composition, by types. Chromium A, "obviously basic", is precipitated by cesium sulfate as the alum in the presence of dilute sulfuric acid. This is, or by acid is easily converted into, the hexaquo chromium ion.

Chromium B, "non-colloidal" or "semi-colloidal" does not precipitate with cesium sulfate, nor does it precipitate with dilute sulfuric acid in the presence of alcohol. This is the "latent basic" type.

Chromium C, "colloidal" of the "latent basic" type does not precipitate with cesium sulfate, but does precipitate with dilute sulfuric acid in the presence of alcohol.

The extent of polymerization in basic chromic nitrates was investigated by means of freezing point, conductivity, absorption spectrum and dialysis studies. Also, by studying the time necessary for polymerization to proceed far enough so that the material had peptizing action.

Other studies made included an investigation of the jelling properties of the more basic nitrates, and how these are affected by dilution, temperature, acidity and evaporation of the salt from solution to dryness; pH measurements were made to determine the changes as synthetic basic nitrate solutions aged; and studies were made to see how various electrolytes coagulated the basic nitrate solutions.

CONCLUSIONS

There are three types of chromium in basic chromic nitrate solutions: Chromium A, the "obviously basic" precipitated by cesium sulfate; Chromium B, the "semi-colloidal, latent basic", not precipitated by cesium sulfate nor by dilute sulfuric acid and alcohol; and Chromium C, the "colloidal, latent basic", not precipitated by cesium sulfate,

but is precipitated by dilute sulfuric acid and alcohol.

Chromium A does not peptize silver chloride.

Chromium B and C do peptize silver chloride, with C more than B.

Chromium A is usually a monomeric ion, but may be dimeric or even the hydroxide.

Chromium B ranges from a simple basic ion, indistinguishable by formula from Chromium A, to a dimer which may exist as a slightly dissociated nitrate.

Chromium C appears to consist of aggregates of high molecular weight which may be present either in the ionic form or as more nearly neutral molecules with considerable nitrate radical attached.

Chromium A, if basic, changes on standing into Chromium B and C, the more rapidly the more basic it is. Increase in temperature also hastens the change.

Absorption spectrum studies confirm the opinion that in the basic salts the hydroxyl groups become part of the coordinated complex positive ion.

Additional questions and lines of investigation are pointed out.

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DIFFUSE SCATTERING OF X-RAYS BY SINGLE CRYSTALS

Robert Quinly Gregg, Thesis (Ph.D.)
University of Missouri, 1943

Certain of the recently recognized new aspects concerning the diffuse scattering of x-rays by crystals has been illustrated qualitatively by means of six patterns of rocksalt. Four of these are essentially Laue patterns which were prepared for comparison with two patterns prepared by substituting monochromatic Mo K α and Ag K α x-radiation for the polychromatic radiation customarily used. It is believed that these pictures constitute what is perhaps the most elegant of the many illustrations of diffuse scattering which have heretofore been published.

The main effort was devoted to obtaining quantitative measurements of the characteristics of diffuse scattering by single crystals of rocksalt and aluminum. These measurements were made from films prepared at room temperature using two cylindrical camera of 8.75 cm. and 9.15 cm. radius respectively. The ex-radiation used for these experiments was reflected from a single, flat crystal of rocksalt and the beam was essentially monochromatic, very narrow, and almost parallel. The samples themselves were arranged so that a transmission method could be used, since under these conditions the effect of the surface layers must be very small in comparison to the effects from the protected interior portions. Moreover, by choosing the sample as a flat plate, it was possible to correct the observations by means of a straight-forward method so as to take into account the effect of absorption, within the sample, of the scattered radiation. Quantitative study was limited entirely to the diffuse spots upon the equatorial line of each film. The results were

thus free from difficulties arising from the projection of spots upon flat films and from unequal sample-to-film distances. The circular camera made possible investigations up to a scattering angle of about seventy degrees while the rather large radius facilitated quite accurate determinations of the angular positions of the various diffuse spots.

For rocksalt, three radiations, Mo K α , Ag K β , and Ag K α , have been used to prepare six patterns using three orientations of the sample. For each radiation, the several patterns have been given appropriate inter-comparisons of intensities. These fully corrected curves constitute the most complete description of results. Although it was not specifically intended that the patterns for different wave-lengths should also be inter-comparable, it is nevertheless believed that this is actually the case. These patterns show prominent peaks superimposed upon a general level of weak radiation. From these films the scattering angles for nineteen true diffuse spots have been determined. An estimate of the angular half-widths of these peaks at half-maximum intensity has been arrived at on the basis of a reasonable allocation of the general-level intensity.

For a single crystal of aluminum, two radiations, Ag K α and Mo K α , have been used to prepare seven patterns using four crystal orientations. Six of these exhibited prominent maxima from which the positions of fourteen diffuse spots have been determined. The seventh film did not show any very marked peaks but did show a general-level of scattering similar to that on the other two pictures with the same radiation. For each radiation, an inter-comparison of intensities was made but in this case the inter-comparison of the curves for different wave-lengths was not possible.

All of these various patterns have shown two rather striking features. The first of these was the existence of very sharp maxima in the scattering at certain angles. The second feature was that there appeared to be a general level of scattering whose

magnitude varied only very little with scattering angle and with changing orientation of the crystal. A small but unknown portion of this latter part was unquestionably Compton incoherent scattering although it seemed very likely that the major portion was scattering of the diffuse type.

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THE ACTION OF 1:8 NAPHTHALYL DICHLORIDE IN THE
FRIEDEL-CRAFTS REACTION AND THE STRUCTURE
PROOF OF THE DERIVATIVES OF 8-BENZOYL-
1-NAPHTHOIC ACID

John Edwin Kircher, Thesis (Ph.D.)
University of Missouri, 1943

STATEMENT OF THE PROBLEM

It has been known for some time that 1,8 naphthalic anhydride formed a dichloride upon treatment with phosphorous oxychloride and phosphorous pentachloride. The structure of this chloride was assumed to be that of the symmetrical 1,8 naphthalyl dichloride. However an unsymmetrical dichloride, analagous to the unsymmetrical dichloride of phthalic acid, would seem possible. In an attempt to get reactions of this compound if it should be present, the dichloride was treated with benzene and aluminum chloride. Diphenyl naphthalide and 8-benzoyl-1-naphthoic acid were obtained, indicating the presence of both forms of the dichloride.

The 8-benzoyl-1-naphthoic acid with certain of its derivatives are described in the literature, with two different melting points being listed for the acid.

Further work in the present investigation included the use of the acid chloride of 8-benzoyl-1-naphthoic acid in the Friedel-Crafts reaction, and a study of the various derivatives of this acid chloride in order to determine whether these compounds possessed the closed ring structure (analogous to the naphthalides) or the open structure (analogous to the naphthalic acid). The question of multiple melting points for the 8-benzoyl-1-naphthoic acid was also investigated.

METHODS USED

The 1,8-naphthalyl dichloride was prepared according to methods described in the literature and was allowed to undergo the Friedel-Crafts reaction with benzene and toluene. The reactions were run using excess benzene and toluene as the solvents. The products obtained from these reactions were analyzed for carbonyl groups and active hydrogen with the "Grignard Machine" and their identity conclusively proved by means of mixed melting points with known compounds.

Treatment of the 8-benzoyl-1-naphthoic acid with thionyl chloride and subsequent crystallization of the product from a benzene-petroleum ether solution produced the acid chloride. The acid chloride was treated with absolute ethanol and the mixture of isomers obtained were separated chromatographically. The crude acid chloride, without having been crystallized from benzene-petroleum ether solution, produced the same isomers as mentioned above but in inverse ratio when treated with alcohol and chromatographed on alumina. These isomers were found to be 3-phenyl-3-ethoxy naphthalide and 8-benzoyl-1-ethyl naphthoate. The latter of these compounds was synthesized by the action of ethyl iodide on the silver salt of the benzoyl naphthoic acid. The properties of this ester were compared to those of the ester reported in the literature to be formed by the action of ethyl alcohol on the 8-benzoyl-1-naphthoyl chloride.

The compound obtained by treating the acid chloride of 8-benzoyl-1-naphthoic acid with ethyl alcohol was reported to be an ester but was shown to be 3-phenyl-3-ethoxy-naphthalide by comparison of its absorption spectrum with that of known compounds. In addition the alkaline hydrolysis rate and mixed melting points of the ester reported in the literature and the ester prepared from the silver salt of the acid proved the two compounds to be different.

The absorption spectra were also used to indicate the structures of 8-benzoyl-1-naphthoic acid and its acid chloride.

8-Benzoyl-1-naphthoyl chloride, prepared as previously mentioned, when dissolved in benzene underwent the Friedel-Crafts reaction to give 3,3-diphenyl naphthalide. The structure was proven by a mixed melting point with a known sample of this naphthalide.

FINDINGS

1,8-Naphthalyl dichloride when treated with excess benzene in the presence of aluminum chloride gave 3,3-diphenyl naphthalide in 25% yield and considerable quantities of 8-benzoyl-1-naphthoic acid. When toluene was used in the same reaction 3,3-ditolyl naphthalide was formed in 75% yield, and in addition a small amount of 8-toluoyl-1-naphthoic acid was obtained. These reactions indicated that 1,8-naphthalyl dichloride was capable of existing in the unsymmetrical form analogous to phthalyl dichloride.

The Friedel-Crafts reaction with 8-benzoyl-1-naphthoyl chloride and benzene produced 3,3-diphenylnaphthalide, and the chloride reacted with ethanol to give naphthalide. This evidence along with that of the absorption spectrum of the chloride was taken as evidence that the acid chloride existed as 3-phenyl-3-chloronaphthalide.

It was found that the action of alcohol on the 8-benzoyl-1-naphthoyl chloride which had been crystallized from benzene-petroleum ether solution produced 3-phenyl-3-ethoxy-naphthalide and 8-benzoyl-1-ethyl-naphthoate in a per cent ratio of 85/15. When the chloride was not crystallized from the benzene-petroleum ether solution the preceding reaction gave the same products but in a per cent ratio of 15/85 of naphthalide to ester. From the absorption spectrum and chemical evidence, it was concluded that the 8-benzoyl-1-naphthoic acid existed as 3-phenyl-3-oxynaphthalide. It was also shown by

the absorption spectrum of the acid that the multiple melting points of 8-benzoyl-1-naphthoic acid could not be caused by isomeric forms of the compound.

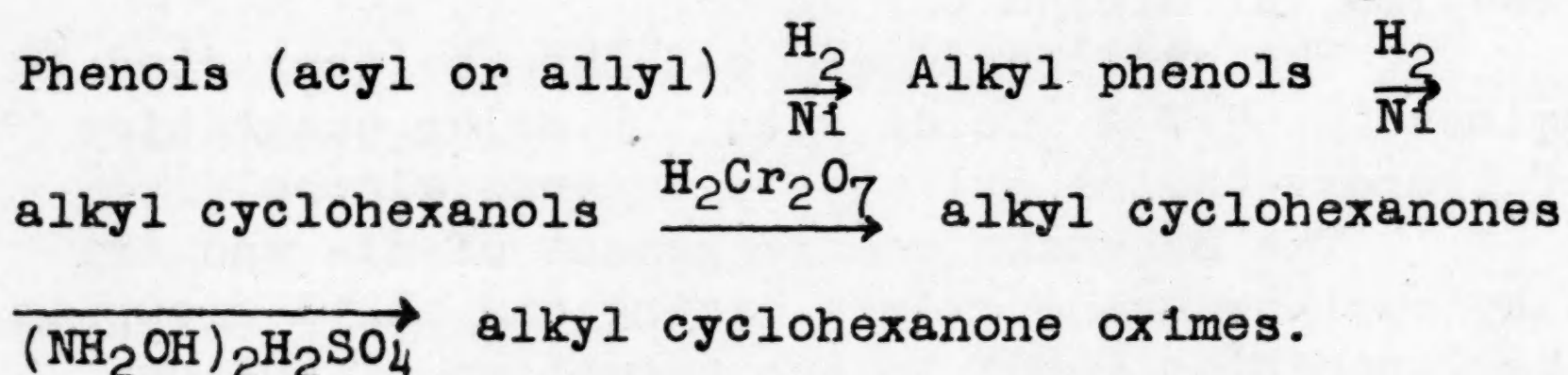
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THE BECKMANN REARRANGEMENT OF CYCLOHEXANONE OXIMES

Arthur Douglas McLaren, Thesis (Ph.D.)
University of Missouri, 1943

The oximes required for the Beckmann rearrangement study have been prepared via the following series of reactions.



The catalytic reduction of alkyl phenols at 120-140° with Raney nickel under a hydrogen pressure of 120 to 180 atmospheres constitutes a convenient method for the preparation of alkyl cyclohexanols if the required alkyl phenols are available. Substituents have little influence on the ease of reductions unless two ethyl or n-propyl groups are in the ortho position. In the latter cases, cyclohexanols are produced only in the presence of alkali. The addition of 1% of 40% aqueous sodium hydroxide has a promoting effect, as evidenced by a lower initial temperature required, for saturation of the benzenoid nucleus in most cases. This promoting effect is lost when the phenol is methylated.

Alkyl cyclohexanols may also be obtained by reduction of allyl or propenyl phenols, which may be prepared through the Claisen aryl allyl ether rearrangement. The reduction, which takes place in two stages, may be stopped after saturation of the side chain at 50°. Saturation of the side chain and reduction of the ring are both promoted by alkali.

Ortho and para acylphenols, available through the Fries rearrangement, can be reduced to alkylphenols at 110° or to alkylcyclohexanols at

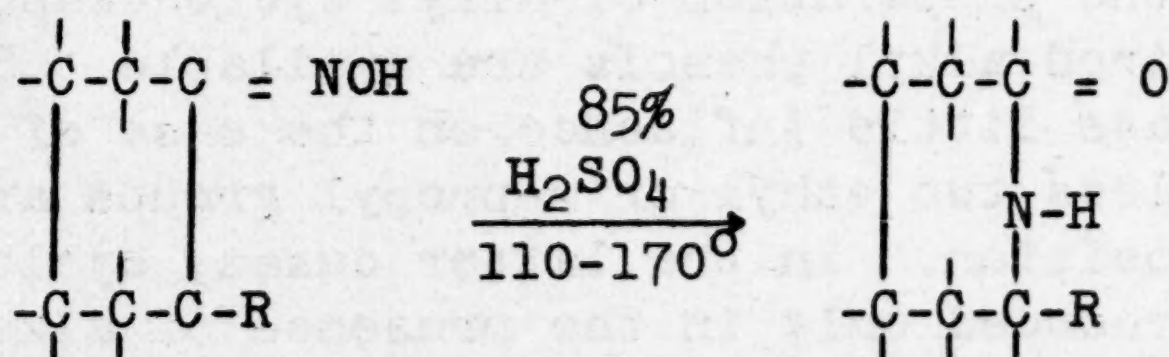
180°. In the presence of alkali, alkylphenols and (1-hydroxyalkyl-) cyclohexanols are produced at 45-55°. At temperatures above 110° alkylcyclohexanols and (1-hydroxy alkyl-) cyclohexanols are obtained.

The hydrogenation of alkylphenols with Raney nickel, with or without alkali, leads to the formation of predominately one of the possible cis-trans isomers.

The cyclohexanols may be oxidized with acid dichromate to give cyclohexanones in 85-90% when the reaction is carried out at 5°.

The cyclohexanones can then be converted to oximes in 65-75% yields with 1.5 molar quantities of hydroxy-lamine sulfate in aqueous alcohol.

The Beckmann rearrangement of di- and tri-alkylcyclohexanone oximes having one alkyl group in the 2 position leads to the formation of but one lactam. The nitrogen atom enters the ring between the 1 and 2 carbon atoms. (Shown with a 2-alkyl group only.)



The structures of the lactams (where R = CH₃) were proved by hydrolysis with the formation of 6-amino-heptanoic acids having the common configuration CH₃CH(NH₂)-R'. Application of the iodoform reaction to these acids (where R = CH₃) resulted in the formation of iodoform. Amino acids having terminal amino groups do not undergo the iodoform reaction.

A list of the new compounds follows.

Cyclohexanols

3-Ethyl, 2,3,5-Trimethyl, 4-Methyl-2-ter.butyl, 2-(1-Hydroxy)-propyl, and 4-(1-Hydroxy)-ethyl.

Cyclohexanones

2,3,5-Trimethyl and 2-ter. Butyl-4-methyl.

Cyclohexanoneoximes

3,4-Dimethyl, 2,4,6-Trimethyl, 2,3,5-Trimethyl, and 2-ter. Butyl-4-methyl.

Hexamethyleneimines

2-Oxo-4,6-dimethyl, 2-Oxo-5,7-dimethyl, 2-Oxo-4,7-dimethyl, 2-Oxo-4,6,7-trimethyl, 2-Oxo-3,5,7-trimethyl, and 2-Oxo-5-methyl-7-ter. butyl.

Acids and the Corresponding Acid Hydrochlorides

6-Aminoheptanoic, 6-Amino-4-methylhexanoic, 6-Amino-3,5-dimethylhexanoic, 6-Amino-4-methylheptanoic, 6-Amino-3-methylheptanoic, 6-Amino-3,5-dimethylheptanoic, 6-Amino-2,4-dimethylheptanoic, and 6-Amino-4-methyl-7,7-dimethyloctanoic.

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THE PREPARATION OF ALKAMINE ESTERS OF ORTHO-ALKOXY BENZOATES

Lawrence John Schroeder, Thesis (Ph.D.)
St. Louis University, 1942

The extensive use of cyclic oxy derivatives as local anesthetics prompted investigation into the possibilities of salicylic acid derivatives in this field. While numerous alkoxy-type anesthetics have been synthesized and studied pharmacologically, previous researches have been confined almost exclusively to the para-alkoxy benzoate types. A study was made relative to the ortho-alkoxy benzoates, substituents being introduced into the salicylic acid nucleus by the formation of appropriate phenolic-alkyl ethers, together with the introduction of various alkamines into the esterified portion of the acid.

Studies were made on the preparation of the methyl o-alkoxy benzoates by direct alkylation with the corresponding alkyl sulfate, as well as the formation of the ethers by a modification of Williamson's synthesis. The second intermediary step investigated involved the definition of the optimum hydrolytic conditions necessary for the conversion of the methyl o-alkoxy benzoates to the corresponding acids. These acids were further converted to the o-alkoxy benzoyl chlorides by appropriate chlorinating agents.

The preparation of the alkamine esters of the o-alkoxy benzoic acids was next studied, relative to their synthesis by direct coupling reactions between the halo-alkyl o-alkoxy benzoate and secondary amines and by esterification of the o-alkoxy acid through the reaction of the alkamine and the o-alkoxy benzoyl chloride. Thirty reactions in this series were studied, resulting in the isolation of twenty-seven compounds. This series included various

alkamine esters of o-methoxy, o-ethoxy, o-propoxy and o-butoxy benzoic acid. The derivatives were isolated as the hydrochloride salts. One of these compounds, beta-diethylamino ethyl o-ethoxy benzoate hydrochloride, has been reported previously in the literature.

It was found that the lower homologues in any series of alkamine esters are the least soluble in non-polar solvents. It was also noted that there is a decrease in melting point with a lengthening of the alkoxy chain. Qualitatively, only slight evidence of local anesthesia was observed when these derivatives came in contact with mucous membranes.

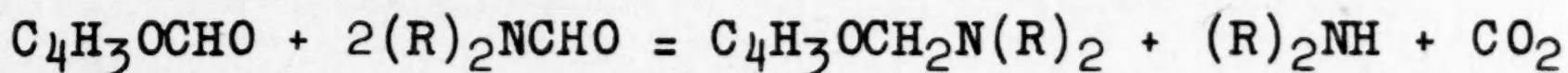
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THE PREPARATION OF SOME QUATERNARY AMMONIUM COMPOUNDS

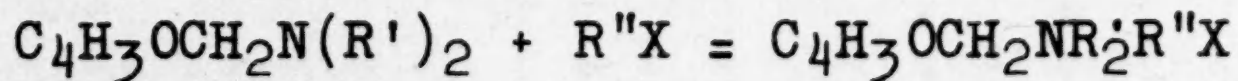
Earl Adam Weilmuenster, Thesis (Ph.D.)
St. Louis University, 1942

In 1935 Domagh discovered that certain quaternary ammonium chlorides possess marked bactericidal activity. Alkyl (C₈-C₁₈) dimethyl benzyl ammonium chlorides are typical examples. The purpose of this work was to synthesize such compounds as above, but possessing the furfuryl nucleus in place of the benzyl radical. N,N-dimethyl furfuryl amine and N,N-diethyl furfuryl amine were prepared from furfural and dimethyl amine and diethyl amine by the Leuckart synthesis. The course of reaction may be illustrated as follows:



The corresponding picrates of these two amines were prepared as suitable derivatives.

A series of dimethyl alkyl furfuryl ammonium iodides were synthesized by the coupling of N,N-dimethyl furfuryl amine with alkyl iodides. In an analogous manner a series of diethyl alkyl furfuryl ammonium iodides and bromides were also synthesized. The course of the reaction may be illustrated as follows:



The -R' groups were either both -CH₃ or -C₂H₅, while the -R'' group varies from -CH₃ to -C₁₈H₃₇.

Some corresponding picrates of the above halide salts were also synthesized.

The halides were analyzed by the Vohlard method; the nitrogen analyses were made by the Kjeldahl method, except the picrates, whose nitrogens were determined by the micro Dumas method

Some preliminary bactericidal activity and toxicity studies were carried out. These results show that the N,N-dimethyl N-dodecyl furfuryl ammonium iodide has the best bactericidal activity and seems to possess little toxicity.

These quaternary ammonium iodides may be useful as disinfectants or wetting agents.

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CHEMISTRY, PHYSICAL

THE OPERATION AND APPLICATION OF THE TISELIUS ELECTROPHORESIS APPARATUS

Chester R. Hardt, Thesis (Ph.D.)
Michigan State College, 1943

The objectives of this thesis are twofold. First, it is written in such a manner that it can serve as a practical working guide for inexperienced workers in the field of electrophoresis. Second, an attempt is made to show the wide and varied application of electrophoresis studies.

The following subjects have been considered both by illustrations and discussions;

1. Historical
2. Apparatus
3. Optical systems for following and recording electrophoretic separations.
4. Methods for determining total protein concentration.
5. Buffers, buffer effects and the preparation of buffers.
6. Conductance measurements.
7. Treatment of electrodes and assembling and filling cells and electrode vessels.
8. Boundary compensation.
9. Heating effects and convection currents.
10. Photographing the boundaries.
11. Calculation of mobilities and relative concentrations.
12. Boundary anomalies.
13. Steps to follow in a complete electrophoretic analysis.
14. Application.

The section devoted to apparatus is freely illustrated with scaled drawings and photographs of the various elements.

The various optical systems that have been used to follow electrophoretic migration are illustrated and discussed.

The part dealing with the determination of total protein concentration includes a consideration of the following methods; refractometric, semi-micro Kjeldahl, heat coagulation and colorimetric.

The section on buffers includes a discussion of ionic strength and sample calculations are given illustrating the preparation of buffers of known pH and ionic strength. The preparation of the more common buffers used in electrophoresis work is facilitated by a table listing the composition of various buffers.

The more common methods used to chloridize electrodes are outlined.

The theoretical aspects of boundary compensation and heating effects are illustrated and discussed.

Detailed illustrated descriptions are presented covering the mechanical manipulations involved in photographing the base lines, initial boundaries and in scanning the boundaries.

Specific examples are given to illustrate the method of calculating mobilities and relative concentrations.

The more common boundary anomalies are discussed in a separate section. These include discrepancies between ascending and descending patterns, the beta boundary disturbance and other more common anomalies.

Finally step by step directions are given for making a complete electrophoretic analysis with the Tiselius apparatus.

The discussion on application is a compilation of previously reported work supplemented by work of the author. The topics in part include the following: (1) Studies on normal and pathological human and animal blood serum and plasma, (2) immunological studies, (3) protein fractionation, (4) heat denaturation studies on proteins and (5) enzyme and hormone studies.

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ECONOMICS

COLLECTIVE BARGAINING UNDER THE NEW DEAL, 1933-1941

Alphonse H. Clemens, Thesis (Ph.D.)
St. Louis University, 1941

Prior to the National Industrial Recovery Act, the legal status of collective bargaining was uncertain and indeterminable. A corollary of unionism, it was early held an inalienable right by those workers banded together in labor organizations for the protection and acknowledgment of their natural rights. However, this right was not given its proper recognition in the labor legislation and the decisions of courts. The preponderance of court decisions and interpretations seem to be such as to restrain if not directly militate against the practice of collective bargaining. The common law, which until recently, was the chief source of legal argument and decision in this matter was rather conservative or repressive in deciding labor cases. The doctrines of criminal conspiracy and restraint of trade, basic in American common law and English statutory and common law, were repeatedly invoked to check the powers of labor organization and unionism. Even the Sherman and Clayton Acts, which organized labor hailed as its Magna Charta, were so interpreted by the courts as to conform to the spirit of the common law interpretation. The right to organization and collective bargaining was little enhanced by these enactments.

With the hope of guaranteeing labor's right to bargain collectively and insure a greater industrial peace. Clause 7(a) was inserted in the National Industrial Recovery Act. The administration of this law introduced a new era in labor relations as well as modified the legal and economic status of employer and employee. The unconstitutionality of the N.I.R.A. led those sympathetic to labor to

seek to preserve the gains of Clause 7(a) by the enactment of another law known as the National Labor Relations Act.

An attempt has been made to examine in detail the provisions of these laws, the Boards created for their administration, the varying and oft-times contradictory interpretations of the law, the procedure and practices engaged in, the attitudes of the Courts, of employers and employees and the serious indictments hurled at the Boards.

The data offered indicate that as a whole the new labor legislation has proved effective. However, the lengthy experience garnered under both the National Industrial Recovery Act and the National Labor Relations Act, posits the need for some revisions in the administration and enforcement of the law. There are indications that a more specific definition of the meaning and implications of the Act by Congress is needed. The many and costly delays in handling cases pending might well be obviated. An increase in personnel which should be selected through civil service examinations is indicated. Conciliation functions could be returned to the Department of Labor, thus relieving the Labor Board of the undue pressure of work. The C.I.O. and A.F. of L. disputes, so destructive of the purposes of the Act, might be obviated were an amendment added to the Wagner Act specifically stating the method of selecting the proper bargaining unit. In whatever manner the balance of power between capital and labor has been unduly tilted, it should be restored to an equilibrium. Some set of rules of evidence, not as formal as those obtaining in courts, should be established for Board procedure. The "separation of powers" doctrine, traditional in our democracy, might well be preserved in this day of over-concentration of power. Labor courts staffed by labor specialists, would insure greater expertness and would expedite the decisions of judges. At the same time, trial examiners could

function subject to such courts rather than under the supervision of the Labor Board.

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FLUCTUATIONS IN URBAN RENTS, THEIR CAUSES AND IMPLICATIONS

Roy Wenzlick, Thesis (Ph.D.)
St. Louis University, 1942

Inadequate consideration has been given to the analysis of urban rents by economists although urban rents in dollar volume are of greater importance than the rents of farm lands, covered in great detail in all economic discussions.

In order to arrive at an adequate theory of urban rents, an index of residential rents was constructed for the United States from 1851 to 1942. This was compared with construction costs, interest rates and general cycles of real estate activity. It was found that the rent theories of the older economists have very limited application to the rents of residential property. These rents have fluctuated more nearly as prices would be expected to fluctuate for any durable good with a long life. The general principles explaining these fluctuations were formulated as follows: "At a given time in any community the level of residential rents will be determined by the relationship of the demand for any particular property to its supply. In the long run period the level of rents will depend on the monthly cost of ownership of new increments to the supply." It was found that in actual practice the influence of replacement costs, financing costs and interest rates was so great that all other factors had relatively little influence. Economic rent of the land as a percentage of the gross rents was almost negligible.

Rents of retail locations are explained to a far greater degree by the marginal concept as economic rent forms a far greater part of the gross rent. The differential advantage of accessibility was found to be the greatest determinant. This was

measured by the quality and quantity of pedestrian traffic.

Rents of office space are determined in much the same fashion as residential space with some allowance for the marginal concept. Industrial rents are generally fixed indirectly by non-industrial competition for land.

It was found that the HOLC had prevented a complete collapse of rents and values in the depression, that the FHA had lowered rent because of lower financing costs and interest rates, that an increase in real estate taxes had increased rents, that rent control is of uncertain value and that subsidized rents threaten private building and private ownership.

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EDUCATION

A PATTERN FOR ADULT EDUCATION Community Survey and Program

Louis Herbert, Thesis (Ph.D.)
New York University, 1943

The Problem

Objectives are to (1) demonstrate the value of a community survey technique in planning adult education for an ailing urban community; (2) analyze community resources and their implications for adult education; and (3) determine relevant responsibilities and opportunities of public schools.

Significance of Problem

The school is considered responsible to all the people for meeting the educational needs of the whole community. The investigator anticipated that the survey technique would help clarify this responsibility. The study attempts to demonstrate how schools can lead in developing over-all patterns of adult education for ailing urban areas, on the basis of factual community studies.

Limitations of the Study

(1) Surveys differ according to social conditions and problems. Ever-changing needs require constant modification of social programs. (2) The absence of accurate objective criteria makes it difficult to judge the enduring practical results of a community survey. (3) Personnel and funds were restricted with consequent inaccessibility of additional information.

Procedures Used

These include: (1) analysis of demographic data; (2) community survey, involving study of neighborhood map and inspection of area; contacts with community agencies; interviews with representative lay and professional people; interviews with workers serving community agencies; visits to schools and

other institutions to observe programs; questionnaire studies; construction of social map of neighborhood; summarization of results; (3) description of community structure; and (4) study and presentation of implications for a pattern of adult education in this typical ailing urban community.

Area under Survey

The area contains thirty-five New York City blocks, a neighborhood extending from the north side of Third Street to the south side of Ninth Street, from the east side of Third Avenue to the west side of Avenue D, in the borough of Manhattan.

Characteristics of the Area

There is a dearth of community services and of purposeful adult education. Educational opportunities in adjacent areas are limited.

The locality is rapidly becoming depopulated. There are little racial homogeneity and numerous fairly distinct social groups, on a relatively low economic level. Many of the women work. Unemployment has decreased.

Three significant problems for the adult educator center in family relationships, health and recreation, and Americanization. Housing and other conditions related to these broad problems define the locality as an ailing area.

Current educational programs of community agencies were not conceived as adult education per se, but were merely incidental to other objectives.

In planning co-ordinated programs of adult education, existing agencies and leadership may form points of departure.

Community Needs in Adult Education as Reflected in the Judgments of Leading Citizens and Organizations

New policies and programs were suggested, e.g., informal activities; assistance to foreign-born parents, in literacy, Americanization, and family relationships; home visitors for individual counselling; instruction in nutrition, consumer

education, homemaking, home nursing and home hygiene; organized recreation for youth; work in intercultural relationships; and a center of information concerning local educational opportunities.

The reactions of individuals and organizations indicated the potential educational values of the community survey. Valuable data and judgments were contributed by co-operating agencies and individuals.

Judgments of leading citizens concerning the adequacy and extension of educational resources resulted in numerous specific recommendations for adult education in this area.

Summary of Interpretations and Implications for Adult Education

1. The philosophy of education assumes: education is continuous from birth to the end of life; the community exists by virtue of and for its individual members; social efficiency depends on proper community co-ordination; despite individual differences, all men are much alike in seeking basic designs for living; knowledge about the community is requisite to social planning; the dynamics of life cannot be arrested; and programs of adult education should be functional, active, positive, flexible, and fluid.

Implications and interpretations are based on the combined experience, research, and judgments of numerous organizations and individuals. These implications and interpretations form a suggestive pattern of adult education, founded on objective data and competent authorities, and thus demonstrate the worth of the community survey technique.

2. The school should assume a new relationship to the community and to extra-school educational activities. It should place less emphasis on immediate educational techniques. It should become an active key participant in the total educational services for the community. Consideration should now be given to immediate use of existing

facilities and to the conversion of extant school buildings for community purposes. The school should serve as the chief agency, not only to fill in educational gaps, but especially to help co-ordinate and plan educational programs.

3. Adult education programs for this neighborhood should be carried out through a community center and a community council. The center and the council should be run in a fully democratic fashion, as a proving ground for functional citizenship.

4. Liberal use of volunteers is recommended, but volunteers should not replace the paid staff.

5. An information service should be made available to individuals and groups.

6. Advisement and guidance should also be made available.

7. Education in preventive as well as therapeutic personal and family hygiene, home nursing, nutrition, and in health areas such as pre- and post-natal care, should be provided along broad, simple, concrete lines.

8. Education in the psychology of family relationships should be provided in simple, non-technical language.

9. Consumer education is suggested, with instruction in nutrition and diet, and lessons in food preparation.

10. Services are recommended to meet the special needs of youth for personal and group guidance, meeting places, recreation centers, and social gatherings. Youth should have representation in the community council and opportunity to co-operate in planning their own programs.

11. Various types of recreation and leisure-time activities should be organized, to include the development of hobby clubs, activities in the arts and crafts, music, dancing, and dramatics.

12. The need of a functional program of citizenship education is also implied by the data and judgments consulted.

13. Along with the citizenship education program, remedial instruction in English and other fundamental subjects should be organized.

14. Vocational education, also remedial, is recommended, to help workers whose job skills are inadequate; dislocated workers; those who wish to prepare for participation in the war effort; workers who need refresher courses; and professional workers and homemakers interested in household handicrafts or in the use of small tools.

15. An activity program to foster intercultural relationships and understandings should be planned.

16. Formal and informal activities are needed to educate citizens for total defense. Defense groups can be organized as the vehicle for integrating all educational activity.

17. In the total educational program, the schools can exercise leadership. This function will require tact and diplomacy of a high order if the schools are to guide the community toward self-direction instead of continued dependency on the superimposed judgments of outsiders.

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A CASE-STUDY EVALUATION OF THE OXFORD METHOD OF INDIVIDUALIZED EDUCATION

Edward R. Knight, Thesis (Ph.D.)
New York University, 1943

Sponsoring Committee

Professor Paul R. Radosavljevich, Chairman
Professors Charles E. Skinner and
Frederic M. Thrasher and
Assistant Professor Dan W. Dodson

The Problem

The purpose of this research was to evaluate the Oxford Method as an educational procedure. The Oxford Method as practiced at the Oxford Academy, Pleasantville, New Jersey, has been used for thirty-three years in the education of selected intelligent male pupils who formerly had educational difficulties. By evaluating the Oxford Method, its worth in educating a group of these failures will be scientifically determined, pending further research and verification.

Procedure

The evaluation of the Oxford Method was made by using an inductive method based on a technique of representative individual case-studies. The aim of the Oxford Method is to adjust, re-educate and educate intelligent educational failures. This aim then was the criterion with which the results drawn from the case-study data were compared. It was thus possible to evaluate the Oxford Method as an educational procedure and determine whether it was successful.

The investigation was concerned with all of the students enrolled over a five-year period, from July 1936 to June 1941. This comprised a total of forty-nine boys. Case-study summaries were made of

these forty-nine pupils, indicating the basic nature of each of the problems, the essential elements of the treatment, and a follow-up study. From these forty-nine case-study summaries, twelve representative ones were chosen for intensive presentation. In order to assure the representativeness of these twelve cases, the following steps were taken:

1. The forty-nine case-study summaries were classified into four different groups on the basis of the causes of educational failure, depending upon which of four types of causative factors appeared to be the most important factor in each case. All of the cases fell into one of the groups; namely, those which presented social conflicts, those in which the pupil was hampered by personality maladjustments, those in which a previous school was to blame, and those who were impeded by mental or physical limitations. Each case was classified according to its major causative factor, because in the Oxford Method the teaching techniques employed in the educational adjustment of each boy are determined by the factor or factors that produced the educational failure.

2. The number of cases taken from each group was determined by the size of that group. One large case-study was made for approximately every four cases in a group. Because all of the forty-nine cases fall more or less into one of these groups, and as each of the groups is represented according to its size, and as the cases selected are representative of the group from which they were taken, the investigator believes that the twelve cases selected are representative of the whole. This is the method developed by John Dollard for assuring representativeness of intensive case-studies.¹

Summary of Findings

The most significant point to be noted in each of the forty-nine cases was that each boy, despite his former educational difficulties, was

¹Davis, A. and Dollard, J., Children of Bondage. Washington, D. C., 1940. American Council on Education. p. XXIII.

adjusted, re-educated and educated to a degree that enabled him to gain admission to an institution of higher learning.

Although the Oxford procedure was different in each of the cases studied, there were certain principles underlying:

1. The cause or causes of the failure and the personality maladjustments, which were manifestations of the causes, were discovered and removed.

In each case the applicant for admission to the Oxford Academy was subjected to a three to seven day battery of tests and interviews for the purpose of determining whether the boy had the potential ability to do work on the college level, and whether he would be amenable to the Oxford Method. In addition to these data, other information was gathered; namely, former school records, physical reports, information about the social background of the family and the headmaster's notes on interviews with the parents. By studying the data collected about the applicant, it was possible to discover the cause or causes of his educational failure and thus determine whether he would be amenable to the Oxford Method.

Although the approach in the adjustment of each boy was different, certain fundamental procedures were common to all. The program of adjustment was not begun until a bridge was established between the faculty, and especially the headmaster and the school psychologist, and the boy. When this rapport was established, the student was guided in a manner that enabled him to gain insight into the fundamental nature of his problem--its causes and manifestations. When this was accomplished, new, desirable habits were substituted for the old. With careful guidance these new habits eventually became fixed.

2. A system of education was devised for each student, depending upon the various personal factors that influences his learning.

The method of teaching that best suited the boy's needs was determined by experimental means and by testing.

3. All of the teaching under the Oxford Method was completely individualized--there were no classes.

Each boy was taught individually in each subject and he progressed at his own tempo of learning.

4. The technique of teaching consisted of the master questioning the student in the Socratic manner--an inductive procedure.

The master brought forth from the pupil that which he already knew and by questioning on the part of the master, the pupil was able to associate the new material with the old. In effect the pupil arrived at his own conclusions with the master as his guide.

5. All related subjects were integrated and each course was taught vertically.

Thus mathematics was taught as one allied course with arithmetic, algebra, geometry, etc., combined. Education was applied vertically in each course, rather than in the traditional horizontal, class method. By testing it was determined at what level in each course the pupil's background knowledge ended. Then regardless of whether the student had credit for the course from another school, his education in that course was begun at the level of his background.

6. The rate of learning was accelerated.

As each boy was taught individually, he was able to proceed at his own tempo of learning unimpeded by classmates. For this reason

each of the forty-nine boys in this study was able to make up all or most of the time that he had lost, in addition to acquiring the preparation necessary for college admission.

7. Each pupil was instructed in the art of studying so that he would be able to derive the greatest possible learning from his efforts.

8. Each boy was prepared for higher education in the field in which he had the best chance to succeed because of his abilities, interests and aptitudes.

The principles and techniques of the Oxford Method discussed above based on the case-study data, point to the reasons for the success of the Oxford Method with the group of forty-nine erstwhile failures.

Qualifications of the Findings

The Oxford students had all been carefully selected and only those who were amenable to the Oxford Method and who possessed the necessary psychological and social qualities needed to succeed in college were accepted. None of the boys had any psychotic or bad behavior tendencies, and all but eight had I.Q.s of 110 or over and none was below 105.

All of the boys in this study came from wealthy families. The Oxford Method may not be successful with failures whose parents are in the lower economic groups.

Conclusions

The major conclusion of this study is that in all of the forty-nine cases treated by the Oxford Method, despite former educational difficulties, the students were adjusted, re-educated and educated to a degree that enabled them to gain admission to an institution of higher learning.

Educational Implications

The findings of this study point to the proposition that educational rehabilitation ultimately reaches a "dead end" when superimposed advanced learning is laid on a foundation of maladjustments--educational and/or emotional. The causes and the manifestations of the educational failure must be removed so that re-education and education can take place unimpeded. The investigator believes that a large portion of the intelligent scholastic failures can be educationally rehabilitated and thus prepared for their ultimate roles as leaders in our society. The Oxford Method, which this study has shown to be successful, should be one approach to the adjustment, re-education, and education of these failures.

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PROBLEMS OF ARTICULATION BETWEEN THE JUNIOR COLLEGE AND THE UNIVERSITY

Frederick James Marston, Thesis (Ph.D.)
University of Missouri, 1942

This study purports to ascertain by means of the information blank technique to what extent various aspects of the adjustment of a junior college transfer in an institution of higher learning constitute problems of articulation. The data for the study were derived from three information blanks which were formulated from the problems of articulation suggested in the investigator's accumulated correspondence of twenty years with university registrars, other junior college and university officials, and junior college graduates who had entered a university. Care was taken to lift every suggested problem from the text of the correspondence in the exact language in which it had been stated and to insert it into its proper place in one of the information blanks with merely those changes in phrasing necessary to cast it in interrogative form.

It was assumed that the only method to ascertain to what extent the suggested problems of articulation between the junior college and the university were actual problems was to seek, by the use of the information blank technique, the opinions of those who were in the best position to reply informatively: registrars, other university and junior college officials, and, particularly, the students themselves who had transferred from a junior college to a university. It was realized at the outset that either an educator or a student might give an opinion which could be adjudged wrong in the light of correct educational procedure, but it was decided that the fact that he held that opinion was of more consequence than whether it was right or wrong. It

was judged that the information blank technique would provide a valid compilation of the existing opinions regarding the suggested problems.

This study takes the point of view that the necessary adjustments made by a student passing from one unit of the educational process to another must be made as easy as feasible; that poor articulation results when those adjustments are too difficult; and that the methods which may be found to solve the adjustment problems of today may have to be modified or even superseded in ascertaining a solution for the adjustment problems of tomorrow.

This investigation is limited to an examination of opinions as to what practices now existent in junior college and universities affect articulation. It does not concern itself with what procedures might be considered ideal. It takes no account of any changes in the structural organization of the university to establish a Junior College Division within the larger institution. While the majority of the responses to the questions in the information blanks are from Arkansas, Illinois, Iowa, Kansas, Missouri, Nebraska, Oklahoma, and other states belonging to the North Central Association, and Texas, the coverage throughout the entire country is wide enough to warrant the assumption that the sampling is representative.

This study is limited further by the fact that it is a preliminary study, neither suggesting that the problems herein discussed are the only hindrances to the adjustment of junior college transfers in the university, nor maintaining that the solution of those problems would obviate the necessity for continuous attacks upon factors of inarticulation.

The major problems of articulation between the junior college and the university are considered, by the investigator, to be those suggested problems of articulation which, it appears from the data, probably were of concern to more than fifty per cent of the 428 respondents to 142 questions who had

transferred from a junior college to a university, or probably were of consequence in more than fifty per cent of the institutions represented by the 90 registrars who responded to 52 questions and the 259 registrars, other college officials, junior college leaders, and members of the state committees of the Secondary Commission of the North Central Association, who replied to 60 questions.

The study lists forty such major problems under the following headings:

1. Those arising from the attitude toward the junior college in general;
2. Those caused by the attitude toward junior college courses in transfer;
3. Those due to the attitude toward junior college grades in transfer;
4. Those encountered by the transfer in university courses;
5. Those connected with education and vocational guidance;
6. Those growing out of the differences between the junior college and the university as to study and teaching techniques; and
7. Those concerned with social relationships in the university.

A similar number of specific suggestions are phrased in terms of what, in the light of the data assembled; some responsible official in every junior college, generally the dean, should do to work toward the solution of the problems of articulation.

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THE GROWTH OF AN EDUCATIONAL PHILOSOPHY
SUPPORTING A BROAD FORM OF MILITARY
TRAINING IN DEMOCRATIC SCHOOLS

Aubrey Orlan Pittenger, Thesis (Ed.D.)
University of Missouri, 1943

The advent of that day when swords are beaten into plowshares seems far distant in 1943. Determination of a suitable military policy for the interim is a vital problem that is of distinct concern to education.

Purpose

It is the general purpose of the study to examine current educational philosophy and its background for evidences of points of view that would lend support to, or oppose, a broad program of military training in democratic schools.

Method of Research

The study is a survey of the philosophy of education relating to a limited area. It combines characteristics of both historical and normative-survey research. Although concerned with current philosophy the study must draw heavily from history to lend the perspective essential to an evaluation of the present. The following are the large units of the study:

1. An examination of American military policy with stress upon its beginning.
2. An examination of the development of education in areas especially significant to military training.
3. An analysis of current educational philosophy concerning physical and vocational education.
4. An analysis of educational philosophy concerning the integration of school and citizen activities in both peace and war.

5. An examination of activities which seem to validate the trends found in theory.
6. A statement of conclusions and recommendations that seem justified by the preceding analyses.

Conclusions and Recommendations

The United States has not followed the military policy planned by those who guided the military affairs of the Revolution. Original plans were for a citizen army trained and ready but normally engaged in civilian pursuits. Education was to have a part in its preparation. Physical and vocational education can make important contributions to military training. Modern education has demonstrated the superiority of integration of the subject matter taught with the use made of it in life, as a method of instruction. The program that meets the generally accepted philosophy of the function of education must integrate all its subject matter with the situations in which it functions in the lives of citizens both at peace and at war. School lunch programs, programs for the rehabilitation of crippled children and draft rejectees, the success with which the CCC and the NYA combined work and training, the Nazi success in combining physical and military education, the Soviet success in combining vocational training and actual work; all these testify to the soundness of such education.

The following recommendations are made:

1. A complete inventory should be made of the physical and mental assets of each child.
2. The jobs that citizens do in peace and war should be analyzed.
3. Based on the results of the preceding analyses every individual should be prepared for a definite place in society where he performs some useful function.
4. Every part of the training program of the citizen-soldier which the school can perform should be a part of education. Those

parts schools cannot do should be delegated to other agencies as cooperative training.

5. The exact contribution of each agency to the total program should be stated and responsibility for the part each does should be definitely fixed.
6. Every program is to be regarded as individually designed to suit the needs of one pupil.
7. Tasks definitely pointed in the direction indicated are urged upon education now. By successfully performing those tasks now, schools will justify extended financial support in undertaking a larger program later.

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THE RELEVANCY OF THE PRE-SERVICE TRAINING OF
BEGINNING RURAL TEACHERS TO CERTAIN TEACHER
ACTIVITIES

Ted Roosevelt Ragsdale, Thesis (Ph.D.)
St. Louis University, 1942

This study was undertaken to determine the relevancy of the two-year pre-service training given in Illinois State Teacher-Training institutions to certain teacher activities of beginning one-room-rural-school teachers.

A check-list of 156 teacher activities was compiled and sent to the 506 students who were certificated in 1937 on the recommendation of the Teachers College faculties and who had been placed in teaching positions in rural schools for the school year 1937-1938. Replies were received from 372 (73.5%) of the teachers. However, ninety-nine returned lists were discarded in order to eliminate all replies except those from beginning one-room-rural-school teachers.

The findings of this investigation have revealed what are considered to be serious deficiencies in the pre-service training of rural teachers for major proportions of the activities in the following areas: (1) school and class management, especially activities involved in recording and reporting facts concerning pupils; (2) relationships with the personnel of the school staff; (3) relations with members of the school community; and (4) supervision of pupils' extra-classroom activities. Deficiencies were reported for many of the activities involved in classroom instruction. Perhaps about one-fourth of these deficiencies are serious. Training was most satisfactory for (1) activities in connection with school plant and supplies and

(2) activities concerned with professional and personal advancement.

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ENGLISH

MEDIAEVAL RHETORIC IN SHAKESPEARE

James Edgar Wade, Thesis (Ph.D.)
St. Louis University, 1942

Rhetoric in Elizabethan England had its chief source in a long, uninterrupted tradition. Rooted in the works of Quintillian, the De Inventione of Cicero, and the pseudo-Ciceronian Rhetorica ad Herennium, this tradition continued in an unbroken line through the Middle Ages, and retained its influence until the middle of the seventeenth century. Out of it grew the doctrines of the popular manuals of rhetoric in sixteenth-century England.

During the Middle Ages, the chief modification worked upon this tradition was the merger of rhetoric and poetic within the third division of rhetoric: elocutio. Elocutio was the study of style, almost entirely from the point of view of the figures of speech. These figures, divided into schemata verborum and figurae sententiarum, were considered to be the proper study of poets.

Shakespeare's contemporaries were conditioned to appreciate rhetorical drama and rhetorical poetry because they had inherited this tradition by way of the Middle Ages. In response to the demands of his age, Shakespeare might be expected to have written poetry largely influenced by mediaeval rhetoric.

An examination of Venus and Adonis and The Rape of Lucrece discloses that his poetic is in great part the same as that of the Middle Ages; he makes full use of the mediaeval merger of poetic with rhetoric. A survey of twelve plays, taken in chronological order from 1590 to 1610, reveals the same rhetorical background for his dramas. Shakespeare's poetry and drama were very much under the influence of mediaeval rhetoric.

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FINE ARTS

THE MYCENAEAN PICTORIAL STYLE OF VASE-PAINTING IN THE THIRTEENTH CENTURY B.C.

Sara Anderson, Thesis (Ph.D.)

Bryn Mawr, 1943

In this Bryn Mawr doctoral dissertation an important, but little studied, class of Mycenaean vases decorated with human figures, chariots, bulls, stags, birds, sacral objects, etc., was examined. These vases, several hundred in number, the majority in the British Museum in London, were found chiefly in Late Bronze Age sites in the eastern Mediterranean, particularly in chamber tombs of Cyprus, an island subject to Mycenaean commercial penetration, if not colonization, in the 14th and 13th C. B.C. Although a related class of vases with pictorial representations was found on Mycenaean sites in Greece, the latter have usually been considered so different in style as to suggest separate centers of manufacture. In fact, most scholars equate provenance with place of production and assign to vases found in the East a Levantine center of manufacture, to those found in Greece a mainland one.

Regional styles of Mycenaean pottery, however, cannot be substantiated unless vases of the same date show stylistic differences. Accordingly, a chronology of the Mycenaean pictorial style must be formulated. Since most eastern examples were found under circumstances which render an exact dating difficult, it is necessary to relate pictorial-style vases with the entire sequence of development of Mycenaean pottery, using such criteria as: floral, marine and geometric motives, occurring as the main decoration on non-pictorial-style vases and as filling ornaments on those with figural representations; vase shapes; types of composition; changing techniques. Upon these criteria the relative chronology depends; absolute chronology is furnished by

Egyptian synchronisms for the non-pictorial style. We thus conclude that Mycenaean vases with pictorial representations were manufactured alongside simpler examples throughout the Late Helladic III period (ca. 1400-1100 B.C.).

The main section of this study is devoted to the L.H. IIIB or 13th C. pictorial style and to the shape most frequently decorated with figural representations, the krater with loop handles horizontally set. A number of styles have been segregated: L.H. IIIB:1 (ca. 1300-1275 B.C.) transitional between the 14th and 13th C., in which new motives and the Panel type of composition were coming into existence; five separate stylistic groups which are contemporary and belong to the L.H. IIIB:2 period (ca. 1275-1250 B.C.); a local Levantine style with debased decoration and a very different contemporary mainland style (L.H. IIIB:3) of the late 13th C.

Sources of inspiration for pictorial-style vases and origins of individual motives are discussed. Although the Greek mainland had a long tradition for the use of human and animal representations on pottery, many motives were derived from Cretan art. These motives were diffused, however, not through Minoan pottery, but rather through fresco paintings from mainland palaces, the earliest of which show strong Cretan influence. Fresco prototypes must be postulated for the earliest pictorial-style vases, and this is one of the strongest arguments against Levantine manufacture, since no frescoes which can be connected with these vases have as yet been found in the East. From the evolution of two popular motives, the chariot group and the bull, the change from a naturalistic style which imitated mural paintings to a conventional ceramic style, produced in potters' ateliers along mass-production lines, can be observed.

Finally, the question of localization of ateliers is discussed. Contrary to the prevailing view, the author postulates mainland manufacture for

the bulk of pictorial-style vases found in the East, because of identity of fabric and the synchronous and parallel development with non-pictorial pottery of Greece. Because of the dearth of early pictorial-style material from the mainland, it is assumed that figural-style vases found in the East were manufactured in Greece as a de luxe ware primarily for export. Later parallels for this phenomenon are cited. The recently discovered Potter's Kiln at Berbati, near Mycenae, with fragments of figural-style vases identical with those found in the Levant lends confirmation to this theory. Concerning the colonization of Cyprus, it is concluded that although the main colonization, whereby the island became Greek, took place not long before the Dorian Invasion, there were doubtless Mycenaean trading stations in Cyprus as early as the 14th C. B.C.

In four appendices are tabulated: (1) a list of pictorial motives; (2) shapes decorated in this style; (3) sites yielding pictorial-style vases; and (4) a petrographic analysis of selected potsherds by Professor Wayne M. Felts of the University of Cincinnati.

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GREEK

THE DISCUSSION OF ST. GREGENTIUS ARCHBISHOP OF
TAPHAR WITH THE JEW HERBAN

William Thomas Radius, Thesis (Ph.D.)
University of Michigan, 1939

This thesis is first of all a translation of a Greek dialogue, (hitherto untranslated), in which St. Gregentius, presumably the author, argue with a Jew named Herban about why the Jews do not accept Christianity. It belongs to that class of writings of which Justin Martyr's Trypho is the best known example. The original of our Dialogue occupies 80 columns in Migne (lxxxvi, 621-784) and the translation comes to 150 double-spaced typed pages. My translation is preceded by five essays and is followed by a critical commentary.

The introductory essays are, I The Life of Gregentius, II The Contents of the Dialogue, III The Manners of the Disputants, IV Gregentius's Text of the LXX, V The Dialogue and other Antijudaica:
a) A Comparison of the Texts used by Gregentius and Similar Apologists, b) Literary Affinities of the Dialogue.

Owing to the unsettled conditions abroad it has not been possible to secure photostats of manuscripts. Perhaps more light would be thrown on every part of this work if we had access to manuscripts. That is, however, only a plausible pre-supposition to be tested by a study of the Dialogue. Migne's text, as a matter of fact, is reasonably good and has been checked with the editio princeps (1586) of the Dialogue which was recently acquired by the Library of the University of Michigan.

While the Scriptural quotations agree in general with one or another of the greater manuscripts of the Septuagint, there are numerous departures which give rise to points of special interest. One such point is the corroboration of what

Kenyon, (The Text of the Greek Bible, p. 54), states rather provisionally about the relation of I to Q: "...a text [I] which seems to be...akin to that of Q..." Further, a study of the Scriptural quotations used by Gregentius, especially a comparison of these texts and those employed by other writers of antijudaica, returns a verdict of "not proved" upon Rendel Harris's postulate of the existence of a Book of Testimonies.

The likeness of our Dialogue to Timothy and Aquila has escaped students of the subject and is here set forth in what seems to me convincing detail. The relationship between Timothy and Aquila and the Discussion of Gregentius is by way of Athanasius and Zacchaeus.

Owing to its length, no adequate summary can be given here of the contents of the Dialogue. It records a four-day public debate between the Christian Archbishop Gregentius and the Jew Herban. The presence of a large crowd of both Christians and Jews adds reality to the discussion. The disputants pass from topic to topic at random. The arguments are by no means devoid of interest and there is much here not found in other writings of a similar sort. The aimless and inconclusive dispute is brought to a close on the fourth day by a miraculous appearance of Christ on a cloud. The Jews, led by Herban, believe and are baptized, though, be it said, not until a further miracle has been performed!

The Commentary covers a wide variety of questions: textual problems, linguistic peculiarities, discussion of theological doctrines and similar matters.

It may perhaps not be out of place to remark here the complete absence of any studies of this Dialogue. This lack has contributed to the difficulties of this thesis.

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HISTORY

OBERLIN AND THE ANTI-SLAVERY MOVEMENT UP TO THE CIVIL WAR

Clayton Sumner Ellsworth, Thesis (Ph.D.)
Cornell University, 1930

By the time of the Civil War, Oberlin College had become one of the leading educational institutions in this country as well as a center of radical humanitarian reform movements. During the period from its inception in 1833 through 1866, about eleven thousand students matriculated at Oberlin. Since a majority of the graduates became teachers and preachers, and many others may have done so without completing their work, the influence of Oberlin was considerable. This thesis is an attempt to describe the anti-slavery character of the town and college where these students received their training, and, if they were receptive, their ideals.

The subject seems to fall logically into seven parts. (1) The anti-slavery movement in Oberlin began in 1835 when the trustees of the institution, constrained chiefly by the founder, John J. Shipherd, voted to admit colored students. (2) The flame thus kindled was fanned by such leaders as Asa Mahan, Henry Cowles, and Charles G. Finney until it swept the community and spread to adjacent states. (3) Its course was threatened, but not checked, by the efforts of the Ohio Legislature to repeal the charter of the institution, and to cripple it wherever possible. Legislative hostility came to a climax in 1843, when a repeal bill was defeated by one vote. (4) The movement, which heretofore had been limited mainly to moral suasion, now changed its emphasis to political action. The votes of the community were given to the Liberty, Free Soil, and Republican parties. And Professor James Monroe was elected to the Ohio Assembly, where he

secured the passage of a personal liberty law, introduced a bill providing for negro suffrage, and successfully resisted proposed legislation unfavorable to the negroes. (5) The repeal of the Missouri Compromise so aroused Oberlin leaders to the need for renewed efforts against the slavery interests, that they organized and sustained the Kansas Emigrant Aid Association of Northern Ohio, which sponsored a series of seven emigrant aid companies to Kansas.

(6) Oberlin had long put her anti-slavery principles into practice by frequent assistance to fugitive slaves. This aid ran afoul of the law but twice: in 1841, in the "Oberlin Negro Riot," the course followed was avowedly legal; by 1859, the Oberlin-Wellington Rescuers considered themselves answerable only to "the higher law." (7) Violence as a weapon had been considered before the Civil War. At least one of the emigrant aid companies left for Kansas prepared to fight. When John Brown attempted to precipitate a civil war in the fall of 1859, one colored man from Oberlin was killed in the raid, and another was executed for taking part. Abundant sympathy was aroused thereby in Oberlin. In the spring of 1861, when President Lincoln called for volunteers, Oberlin--the community which scarcely two years before had defied the Federal authorities--now responded in a burst of patriotism with men, women, and money.

This thesis is based upon the manuscript material preserved in Oberlin and the Oberlin Evangelist: the extensive collection of Western Reserve newspapers in the Western Reserve Historical Society at Cleveland; and upon the anti-slavery pamphlets and newspapers in the Samuel J. May Anti-Slavery Collection in the Cornell University Library.

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THE DEVELOPMENT OF NATIONALISM
IN INDIA 1885-1920

Cornelia Munz Paustian, Thesis (Ph.D.)
University of Missouri, 1942

British power in India was implanted and maintained by the gradual growth of economic and military strength; until the modern era the British position in India, in the main, was supported by public opinion which constituted the powerful factor of prestige. Aspects of the power gained by Great Britain in India are evident in the manner of maintaining traditional control over the population; official (established by law) control over the destiny of individuals, rewards in the form of titles, medals and employment for loyalty, and the spread of the idea of British trusteeship for India in the form of propaganda.

The bases on which a national consciousness developed in the nineteenth century in India were provided by various factors implicit in the penetration of the country by western influences. The adoption of the English language as the official means of communication in the administration and its dominance in the educational system determined the rise of a class of educated Indians in various sections of the country who had free access to the western literature of liberal idealism. Western capital and the spirit of the industrial age introduced new, swift means of communication and travel into India. Railway transportation, motor cars, cheaper rates of postal service and the telegraph system enabled English-educated Indians to exchange ideas and enter into discussions regarding political and social issues. Graduates of the new Indian Universities modelled after the University of London became editors of a new critical Indian press.

Incorporating the experience of earlier commercial, political and religious organizations the All-India National Congress formed the main channel through which the aims of nationalism in India became articulate and widespread. Beginning in 1885 with less than a hundred members the organization was successful in establishing itself as a representative All-India body by means of provincial affiliate societies. Professing a spirit of loyalty to Great Britain, members of the Congress began to examine the implications of economic and political relations with the mother country.

The first thirty-five years of the career of the Indian National Congress indicate a spirit of moderation in the resolutions which were passed regarding a greater share of governmental responsibility for the people of India. However the acceptance by the Government of India of the Moslem plan for separate communal representation in the legislatures constituted a portent of future politico-religious strife between the various communities. According to British authorities this problem has been the greatest obstacle in granting self-government to India.

Loyalty and aid to the Allies in the first World War induced Indian nationalists to anticipate an advanced grant of political power directly following the war. The actual reforms which were legalized in the Montagu-Chelmsford Act of 1919 were disillusioning. The important portfolios of finance and defense were maintained strictly under the control of British officials while the extraordinary powers of emergency legislation and veto were retained for the Viceroy and the governors of the provinces. Resentment was further aroused by the severe punitive measures known as the Rowlatt Bills, which led to the Amritsar massacre in 1919, and the Moslem agitation regarding the peace measures which the allied victorious nations proposed to negotiate with Moslem Turkey. Post-war economic depression in India geared-in with political and social causes to

heighten the dissatisfaction with foreign rule germinating among Indian leaders.

These factors succeeded in converting the moderate principles of political bodies into directly revolutionary aims. The wide following which Mohandas Karamchand Gandhi had acquired throughout India pointed to his leadership of the nationalist movement at the end of our period of study. Meanwhile, the extra-political bodies originating among Nationalists of various religious beliefs together with the new opportunities for Indian representation in the Legislatures were providing training for the rise of other capable Indian leaders and statesmen. For a short time all Indian parties joined in a common resentment against the injustice of an alien government and economic domination, declared themselves to promote independence of Great Britain and signed the fateful Non-Cooperation resolution.

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FRANCIS PARKMAN AND THE SPIRITUAL
FACTORS AT WORK IN NEW FRANCE

Sister Mary Purissima Reilly, O.P., Thesis (Ph.D.)
St. Louis University, 1942

Francis Parkman is generally considered the leading historian of New France. Though he wrote over fifty years ago, he has not yet been superseded in his chosen field, and he probably never will be. Until recent years, his literary talent, his painstaking research, and his selection of the dramatic period of seventeenth-century France in America bade fare to place him among the immortals of American historiography. But Parkman wrote of a period in which spiritual forces played a dominant role. Unfortunately, he approached his task with a blind-spot: he was possessed of a rationalistic contempt for the supernatural, though he perceived that "supernaturalism is the key to the history of New France." Furthermore, he used his talents and research to uphold a thesis conceived in Puritan prejudice: the superiority of English Protestant civilization over that of French Catholicism.

Until a recent date, criticism of Francis Parkman's work was divided into two schools of thought, namely, those who advanced the tradition of his historical perfection and those who, while granting the obvious merits of his work, protested his lack of spiritual perspective. During the past few years, due to a changing viewpoint on historical writing, the latter opinion of Parkman has been generally accepted. It is the problem of this study to investigate the effect of Parkman's warped attitude upon the interpretation of missionary history, despite his assiduous collection of documents and exhaustive research.

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POLITICAL ECONOMY

THE GREAT POWERS AND THE GREEK DEBT, 1893-1898: A STUDY OF THE CONNECTION BETWEEN INTERNATIONAL FINANCE AND DIPLOMACY

William Manson Hager, Thesis (Ph.D.)
University of Missouri, 1943

The Greeks started their plunge into financial difficulties as early as 1824 when they borrowed abroad during their struggle for independence. The interest rate and other charges proved so heavy that the earlier loans were defaulted. From 1824 to 1893, loan followed loan in attempts to liquidate the earlier indebtedness, but the general result was a pyramiding of the debt. Difficulties increased through doubtful political practices and a resort to large paper issues that tended to force the drachma down and the rate of exchange up on the European market, making it increasingly difficult to meet financial obligations. Thus by 1893 the Greek foreign debt still outstanding stood at francs 458,000,000.

In 1893 a general European financial crisis moved the Greek government to endeavor to save itself by seeking a new loan to fund a part of its debt and suspend temporarily payments on the balance with the hope of stabilizing its internal economy. The European bondholders objected. From 1893 to 1897, the foreign creditors and the Greek government negotiated in vain. The bondholders, before granting a new loan, wished to impose a condominium over Greek finances, which the Greeks would not accept. Although the bondholders appealed to their governments, the powers were too busy trying to keep the European peace as a result of the Armenian and Cretan crises to act in behalf of their investors.

In 1897 the Cretan problem flared up anew. It resulted in a war between Turkey and Greece. The Greeks were saved from annihilation only through the intervention of the powers. This gave the necessary

pretext for taking measures in behalf of their bondholders. Led by Germany, they took care of the holders of the older Greek debt by establishing a control over the Hellenic finances that would assure regular collections of the allocated revenues and meet the premiums upon the foreign obligations of the little state. Then they floated new loans that would meet the war indemnity as well as assist in the stabilization of Greek credit. A settlement was not reached, however, until December, 1896, when the British gave in to the German desire to protect the European bondholders first, and not to award new loans until a financial control had been set up. In this process, occupation of Thessaly by the Turkish army was to continue until the German solution had been complied with.

While the European bondholders got their wish, the Greeks did benefit from the arrangement. Its blow at their national pride was offset by the mild but effective manner of administration in which the Greeks themselves did most of the surface work while the international administrative commission stayed in the background.

So far as the general European situation was concerned, the Armenian, Cretan, and Graeco-Turkish crises had all imposed a considerable strain upon the Concert of Europe. In each of these instances, the British government, unwilling to take the risk of isolated action, had no other recourse than to work with the other powers. Britain had to give in to Russia in the Armenian crisis. She had, in turn, blocked Germany and Russia in the Graeco-Cretan question, but Germany had turned the tables against Britain as a result of the Graeco-Turkish war and forced her solution of the Greek problem upon the powers.

The return of the German government, after futile efforts to cement the relationship between Britain and the Triple Alliance, to the Bismarckian policy of playing close to the Russians has lessened the menace of the Franco-Russian alliance. For that

matter, the French unwillingness to support Russian aggressive tendencies in the Near East had materially assisted in this Russo-German rapprochement. It had influenced the Russian decision to put the Balkans "on ice" while they pursued a new policy in the Far East. This suited the German interests perfectly. They were able to drive the Dual Monarchy into an agreement with Russia for a status quo in the Balkans. It kept Italy stalemated; and British realization of their naval weakness in the Mediterranean meant acquiescence. The Russians, for their part, were all the more convinced of the necessity for the preservation of peace. That is why they were so much concerned in keeping the Graeco-Turkish conflict of 1897 localized.

Thus the Greek financial crisis was solved to the satisfaction of the bondholders because the question became tied up with the larger stakes of European diplomacy.

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ENGLISH GOVERNMENT FINANCE DURING THE
REIGN OF RICHARD III, 1482-85

Julia Ward, Thesis (Ph.D.)
Bryn Mawr, 1943

This study of English government finance during the reign of Richard III deals primarily with three principal sources of income: the ancient ordinary revenue together with the "green wax" or profits of the courts; the customs and subsidies; and the only extraordinary revenue available to Richard III--two clerical tenths of the province of Canterbury. Although the ancient ordinary revenue and the green wax have been ascertained for one year only, 1482-83, on the assumption that this total is representative of any year of the late fifteenth century, the returns from the customs and subsidies are presented for a five-year period, 1480-85, and the income from the two clerical tenths is compared with similar income enjoyed by Henry IV at the beginning of the century. The detailed study of the revenue from these three sources is followed in each case by a description of its expenditure. Because of the form of the documents and the loss of certain of the receipt rolls, the latter is less complete than the former.

A chapter has been added comparing the loans raised during the last two years of Edward IV's reign with those contracted during the reigns of Edward V, Richard III, and the first year of Henry VII, the assumption being that the government's need to borrow and its ability to repay offer some indication of its financial stability. This chapter also includes an examination of the benevolences supposed to have been solicited by Richard III.

A detailed study of the revenue necessarily involves a description of the documents used, an analysis of the interdependence of these documents,

and a study of the procedures involved in some of the financial transactions. This information is given either in the introduction or, where pertinent, at the beginning of a chapter.

In the sections concerned with income, the gross revenue is first ascertained and then by deducting remissions the net revenue. Throughout the study, expenditure is described on the one hand as that recorded in the accounts of local collectors since it was made in pursuance of letters patent or writs of privy seal directed to them; on the other hand, as that recorded in the receipt rolls and the tellers' rolls since the revenue in question was at the immediate disposal of the exchequer. Expenditures of both sorts have been subdivided into categories suggested by Professor H. L. Gray and followed by him in his forthcoming study of fifteenth century finance, viz.,

Expenditures for:

- I. The maintenance of the royal household and its affiliated services:
 - 1. The king's household
 - 2. The queen's household
 - 3. The great wardrobe
 - 4. The king's chamber
 - 5. The king's works
- II. The salaries of administrative and judicial officials of
 - 1. The central government
 - 2. The local government
- III. Annuities
- IV. National defense:
 - 1. Home defense
 - 2. Foreign defense
 - 3. The king's ships
- V. Diplomatic missions
- VI. Purposes not ascertained

Although not more than three fourths of Richard's total revenue and its expenditure has been studied, the investigation shows that during the

fifteenth century there had been a decline, at times slow at others abrupt, in the receipts from the government's principal sources of income. At the same time this diminished revenue was heavily burdened by annuities and special concessions. To offset the decreasing returns Richard dared not ask for an increase of taxation and there is little evidence that he had recourse to forced loans or benevolences. There is considerable evidence, however, that the revenue was inadequate to meet the current needs, and that it was anticipated increasingly by short-term loans and by heavy assignments, some of which were never honoured.

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SOCIOLOGY

FAMILY SUPPORT IN PUBLIC ASSISTANCE A Study of New York Law and Agency Practice in New York City

Harriet L. Goldberg, Thesis (Ph.D.)
Bryn Mawr College, 1942

Every public relief agency and family court is faced with controversies as to when relatives should be expected to help and to what extent, how their capacity and willingness to aid should be determined and how their support should be obtained. This study attempts to clarify various legal, social and administrative problems in this area, as exemplified in New York law and agency practice within the New York City Department of Welfare which encounters cases substantially like those found in other localities.

Discussion is based mainly upon statutes and judicial decisions together with policies, procedures, reports and some hundreds of case situations presented for consultation and advice. Part one deals with liability and provision for support and is followed by chapters on relatives' ability and willingness to assist, current, future and past support or reimbursement, and separate maintenance. Case material is stressed while a description of administrative machinery is included as an aid in understanding practice.

It appears that the concept of family responsibility has been expanded and will survive despite conflicts, for in the structure of our society, the family is interposed between individuals and the community. Even though social planning may restrict the scope of its application to protect young children or elderly persons, the principle itself is fundamental to eligibility for relief.

Detailed analysis proves that the legal basis affords a foundation for flexible, constructive social practice. It offers much more opportunity for

individualization than administrative and social service personnel realize.

All forms of family support are predicated upon a true evaluation of relatives' financial capacity, while the choice of methods to obtain their aid depends upon understanding their attitudes. Many disagreements and difficulties in practice stem from lack of defined standards as to relatives' resources and expenses coupled with inadequate investigation, especially insufficient verification of attitudes. A marked advance is the creation of a scientific standard and schedules as a guide in computing expenses. A diversity of specialized knowledge and skills is applicable - case work, business, legal and home economics. Sufficient emphasis upon voluntary action precludes any necessity for compulsory measures, except in relatively few instances. Most reimbursement cases need never arise if proper attention is given to current and future support.

Separate maintenance requests present complex social and moral issues in which legal and judicial concepts offer some direction. Increases in administrative and relief costs for this type of aid have to be balanced against the social costs of not helping in serious cases.

Improvements come when it is accepted that family support is primarily a social task in a delicate area of personal relationships where abjectivity is hard to achieve, and when administrative elements are integrated to facilitate the use of social case-work concepts. There is no inherent conflict between policies and individualization. Conflicts in daily application reflect either inadequacies of policy or inadequacy in guiding staff. The development of standards and methods, the adaption of written policies and procedures, and the installation of systems, all based upon sifted field experience and coupled with expert consultation service, are indispensable.

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THE GROWTH AND DEVELOPMENT OF GROUP HOSPITALIZATION IN THE UNITED STATES

James Tull Richardson, Thesis (Ph.D.)
University of Missouri, 1943

The purpose of this dissertation was to trace the growth and development of group hospitalization and to try to determine its effectiveness in helping to meet the costs of medical care for low income groups.

Primary sources of data used in the study included personal correspondence, interviews, case records, questionnaires, minutes and transactions while secondary sources embraced reference material dealing with medical and hospital care, data studied in the offices of the Hospital Service Plan Commission and data from the offices of the Research and Information Service of the Hospital Service Plan Commission in Chicago.

Group hospitalization, as it is known today, was preceded by company, single-hospital and city-wide hospital plans. Blue Cross Plans are based upon the Baylor University Hospital Plan organized in Dallas, in 1929, by J. F. Kimball.

The Committee on the costs of Medical Care 1927-1932, crystallized attention on the need for a more comprehensive system of medical care for the low income groups. With the reports of the above committee as a base the American Hospital Association, the American College of Surgeons, the Julius Rosenwald Fund, the Duke Endowment, and the Commonwealth Fund, launched the present Blue Cross Plan movement in 1937.

The Hospital Service Plan Commission is the central organization of Blue Cross Plans in this country. It is supplemented in administrative work by the Council on Blue Cross Service Plans and the Research Program and Information Service.

Legal status for group hospitalization was achieved through legislative acts and court decisions. These legal actions solved three problems: (1) group hospital care was interpreted as service insurance, (2) certain medical services could be included in hospital care, and (3) pay roll deduction for dues of group hospital members was permissible.

The organization and administration of a Blue Cross Plan included preliminary development, sponsorship, financial arrangements and administrative details.

Blue Cross Plans had complete contractual agreements between themselves, their member hospitals and subscribers. There was a great degree of uniformity in the contracts of the different plans as they related to member hospitals and subscribers. The average contract, whether between plan and hospitals or plan and subscribers, contained twelve or fourteen clauses. Contractual relations between Blue Cross Plans, their member hospitals and subscribers were supervised by the various state departments of insurance.

The financial structure of Blue Cross Plans was based upon four accounts including hospitalization costs, administrative costs, reserves, and the investment of reserves. The financial affairs of group hospital care plans were also regulated by the state.

Hospitalization data were studied from thirty-seven Blue Cross Plans. Data were secured from 369 questionnaires and 4,258 case records of hospitalized subscribers. The average number of cases per month, average number of cases per week, percentage of maternity cases, average number of days per patient, number of days per employed subscriber per year, age distributions, costs of hospitalization, incidence of diseases and marital status were considered along with other hospitalization data.

The attitude of business and professional groups toward Blue Cross Plans was determined by

questionnaires. Such instruments were sent to the personnel directors of 300 business concerns in this country and replies were received from 80 of the companies. Questionnaires were also returned by the American Medical Association, the state medical societies, and from the editors of medical and surgical journals. The Blue Cross Plans had been well received by these two groups.

The following conclusions may be drawn from the study: (1) Blue Cross Plans are on a permanent basis; (2) The group hospital movement has achieved a satisfactory legal recognition; (3) Administrative practices of the Hospital Service Plan Commission and various Blue Cross Plans were conservative; (4) The premium rates as charged by the plans were too high for low income groups to pay; (5) The subscribers of Blue Cross Plans were in the comparatively high income classes; (6) Ward care was not offered by a sufficiently large number of Blue Cross Plans; (7) The plans were confined to large cities as a rule; (8) Group hospitalization had been well received by business men and members of the medical profession; and (9) The Blue Cross Plans did not interfere in physician-patient relationships.

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